AVIIVA EM1 GigE

Line Scan Monochrome Camera

User Manual

AVIIVA® EM1
Line Scan GigE Camera

Summary

1 CAMERA OVERVIEW

1.1 Features

- Sensor :
  - 512 14x14µm or 1024 14x14µm or 2048 14x14µm or 4096 10x10µm pixels for Machine Vision versions (BA0)
  - 1024 14x28µm or 2048 10x20µm or 2048 14x28µm pixels for OCT/Spectrometer Versions (BA9)
- Interface : Giga Ethernet in respect with GigE Vision® and GenICam® standards
- Data rate : 4x31.25MHz on the sensor level and close to 120Mo/s on GigE interface
- Bit Depth : 12 or 8 bits
- 100% Aperture, Built-in Anti-blooming, No Lag
- Automatic tap balance and FlatField correction
- Contrast expansion
- Look Up Table
- Standby low power mode
- Statistic functions on ROI
- Very compact design : 93 x 56 x 54 mm (w, h, d)
- Delivered and licensed for Pleora PureGeV® SDK/Driver Package
- DemoGeV application delivered as configuration and acquisition tool and development example.

1.2 Key Specifications

Note : All values in LSB are given in 12 bits format

1.2.1 Machine Vision Versions (BA0)

Characteristics	Typical Value				Unit
Sensor Characteristics at Maximum Pixel Rate					
Resolution	512	1024	2048	4096	Pixels
pixel size (square)	14x14	14x14	14x14	10x10	µm
Max line rate – (in 8 bits)	175	102	55	29	kHz
Max line rate – (in 12 bits)	156	78	39	19	kHz
Radiometric Performance at Maximum Pixel Rate and minimum camera gain					
Bit depth	8, 12				Bits
Response	145	145	145	70	LSB/(nJ/cm²)
Full Well Capacity	117500				electrons
Response non linearity	+/- 0.3				%
PRNU	1				%
Dynamic range	68				dB

1.2.2 OCT/Spectrometer versions (BA9)

Characteristics	Typical Value			Unit
Sensor Characteristics at Maximum Pixel Rate				
Resolution	1024	2048	2048	Pixels
pixel size (square)	14x28	14x28	10x20	µm
Max line rate – (in 8 bits)	102	55	55	kHz
Max line rate – (in 12 bits)	78	39	39	kHz
Radiometric Performance at Maximum Pixel Rate and minimum camera gain				
Bit depth		8, 12		Bits
Response (at 840nm)	99	99	65	LSB/(nJ/cm²)
Full Well Capacity	312500	312500	238000	electrons
Response non linearity		+/- 0.3		%
PRNU		1		%
Dynamic range		70		dB
Power Spectral Density(*)		< 10		-

(*) Power Spectral Density is a specific test for BA9 version. Contact Hotline for more info.

1.2.3 Common Characteristics

Functionality (Programmable via Control Interface)		
Gain	Up to 32	dB
Offset	-4096 to +4096	LSB
Trigger Mode	Timed (Free run) and triggered (Ext Trig, Ext ITC) modes	
Mechanical and Electrical Interface		
Size (w x h x l)	93 x 56 x 54 with lateral heatsinks 60 x 56 x 54 without lateral heatsinks	mm
Weight	310 (without mount but includes lateral heatsinks)	g
Lens Mount	F, T2, M42x1 compliant with AVIIVA SM2 series	
Sensor alignment (see chapter 4)	±100	µm
Sensor flatness	±35	µm
Power supply	Single 12 DC to 24 DC	V
Power dissipation Low power mode	< 11 < 5	W W
General Features		
Operating temperature	0 to 55 (front face) or 70 (Internal)	°C
Storage temperature	-40 to 70	°C
Regulatory	CE, FCC and RoHS compliant	

1.3 Description

The AVIIVA EM1 is designed to set new standards for line scan cameras in term of speed and image quality. With resolutions of up to 4096 pixels, and the design of new CCD image sensors, it delivers state of the art performance, without compromises.
Its rich built-in features, such as automatic FCC, LUT or automatic tap balance, are positioning it as the perfect choice for high demanding Machine Vision Applications (BA0)
A specific rectangular-pixels sensor version (BA9) is dedicated to specific applications as Optical Coherence Tomography (OCT) or Spectrometer.
The EM1 benefits from e2v's long experience in imaging, and the proven qualities of the AviivA family : performances, reliability, and high precision mechanical design.

1.4 Typical Applications

- Web Inspection : metallurgy, wood, paper, textile …
- Process control : pick and place, positioning
- Print Inspection
- Sorting : food, postal, parcel, checks, …
- Surface inspection : wafers, PCB, …
- Document archiving, data archiving
- OCR and barcode reading
- OCT/Spectrometer for **BA9** versions.

1.5 Models

Part Number	Sensor	Outputs	Max Line Rate
Machine Vision versions			***(In 8 bits)***
EV71YEM1GE4010-BA0	4k x 10µm	4x31.25MHz	29 KHz
EV71YEM1GE2014-BA0	2k x 14µm	4x31.25MHz	55 KHz
EV71YEM1GE1014-BA0	1k x 14µm	4x31.25MHz	102 KHz
EV71YEM1GE514-BA0	0.5k x 14µm	4x31.25MHz	175 KHz
OCT/Spectrometer versions			
EV71YEM1GE2010-BA9	2k 10µmx20µm	4x31.25MHz	55 KHz
EV71YEM1GE2014-BA9	2k 14µmx28µm	4x31.25MHz	55 KHz
EV71YEM1GE1014-BA9	1k 14µmx28µm	4x31.25MHz	102 KHz

2 CAMERA PERFORMANCES

2.1 Camera Characterization

2.1.1 Machine Vision Versions (BA0)

	Unit	Min Gain (-24dB)			Av. Gain (-12dB)			Max Gain (0dB)		
		Min	Typ.	Max	Min	Typ.	Max	Min	Typ.	Max
Dark Noise RMS	LSB	-	1.6	2		6,4			27	-
Dynamic Range	-	-	2730:1	-	-	635:1	-	-	160:1	-
Light RMS Noise	LSB	=	11,1	=						
SNR	dB	-	48	-	-	42	-	-	35	-
Non Linearity (between 10% and 90%)	%		1			1			-	
Without Flat Field Correction – Half saturation										
FPN rms	LSB		0,3	2	-	1	-	-	4	-
FPN peak-peak	LSB	-	1,2	7	-	7	-		30	
PRNU hf	%	-	0,07	0,5	-	0,1	-	-	0,2	-
PRNU hf peak-peak	%	-	0,4	3	-	1,2	-	-	1,8	-
With Flat Field Correction										
PRNU hf	LSB	-	2.7	10	-	-	-	-	-	-
PRNU hf peak-peak	LSB	-	17	-	-	-	-	-	-	-

2.1.2 OCT/Spectrometer versions (BA9)

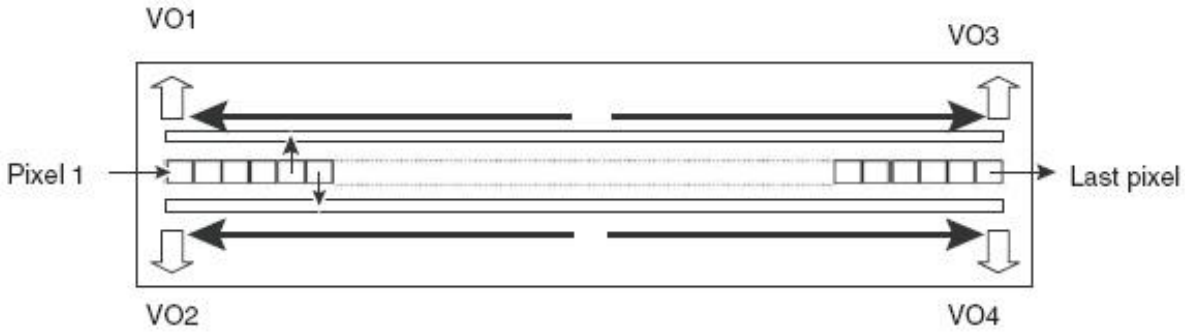
	Unit	Min Gain (-24dB)			Av. Gain (-12dB)			Max Gain (0dB)		
		Min	Typ.	Max	Min	Typ.	Max	Min	Typ.	Max
Dark Noise RMS	LSB	-	1,25	2		6,4			27	-
Dynamic Range	-	-	3276:1	-	-	650:1	-	-	165:1	-
Light RMS Noise	LSB	=	7,7	=	=		=	=		=
SNR	dB	-	48	-	-	42	-	-	35	-
Non Linearity (between 10% and 90%)	%		1			3			-	
Without Flat Field Correction – Half saturation										
FPN rms	LSB		0,15	2	-	1	-	-	4	-
FPN peak-peak	LSB	-	0,9	7	-	7	-		30	
PRNU hf	%	-	0,07	0,5	-	0,1	-	-	0,2	-
PRNU hf peak-peak	%	-	0,4	3	-	1,2	-	-	1,8	-
With Flat Field Correction										
PRNU hf	LSB	-	2.7	10	-	-	-	-	-	-
PRNU hf peak-peak	LSB	-	17	-	-	-	-	-	-	-

Test conditions :

- Figures in LSB are for a 12bits format.
- Measured at exposure time = 100µs and line period = 100µs
- Light source 3200K with BG38 filter 2 mm thickness
- Stabilized temperature 30/40/55 °C (Room/Front Face/Internal)
- SNR Calculated at 75% Vsat with minimum Gain.

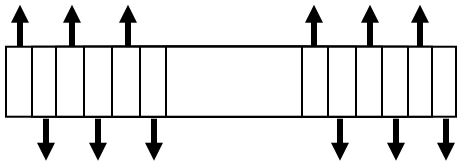
2.2 *Image Sensor*

The Tap structure of the sensors is the following :



On the BA9 Versions, the pixel is rectangular in order to facilitate the positioning of the Camera in the spectrometer :

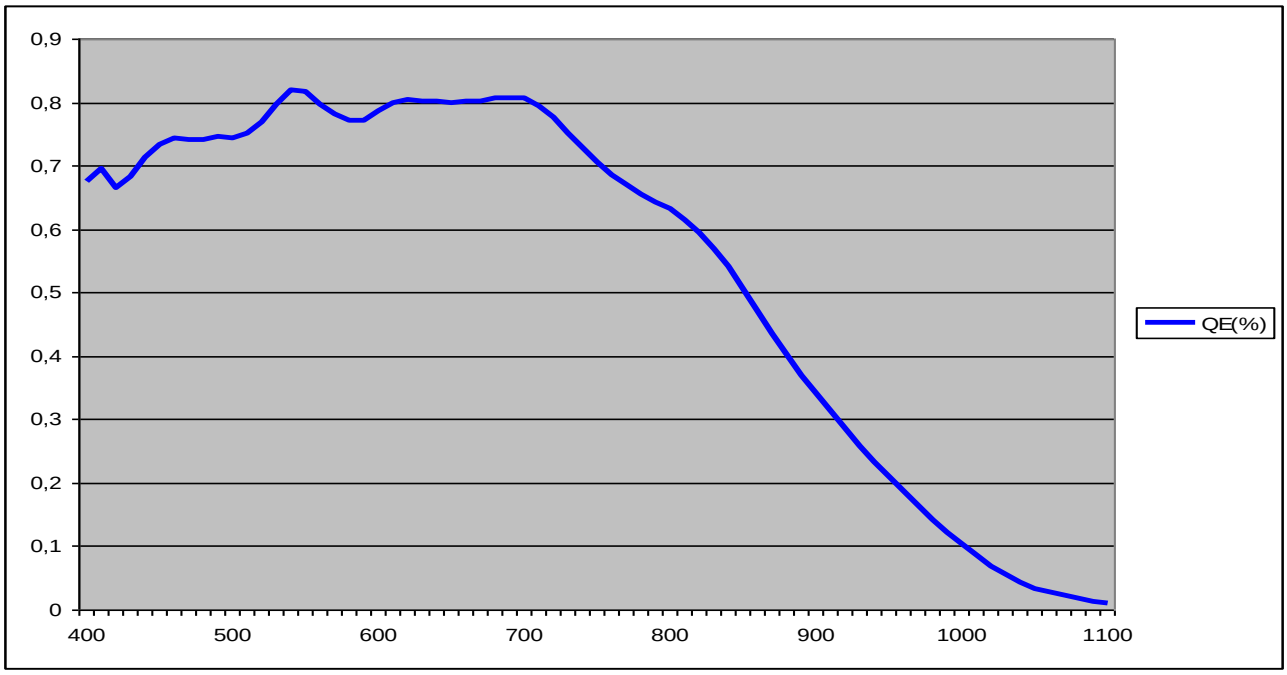
- 20µm height for the 10µm pitch.
- 28µm height for the 14µm pitch.



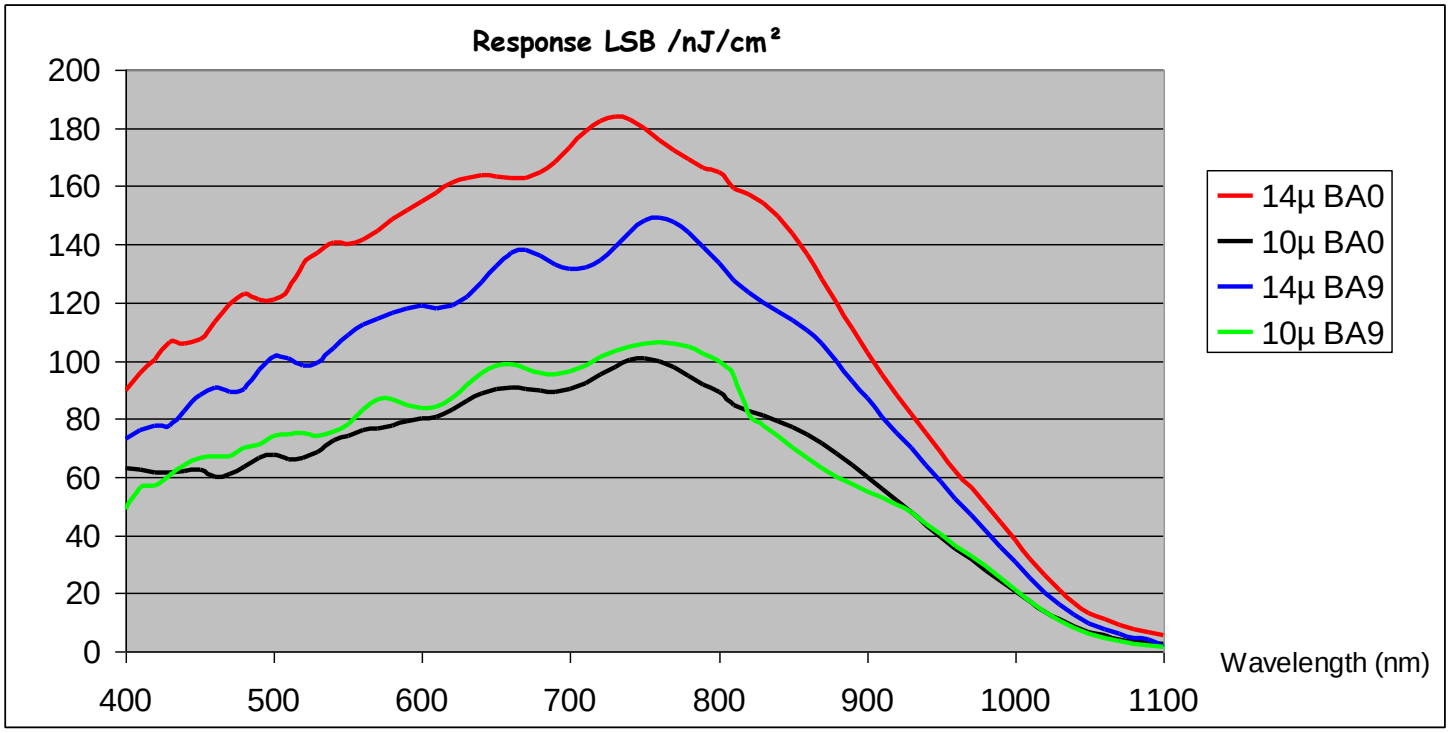
A custom height (up to 100µm for the 10µm pitch and 50µm for the 14µm are possible on demand : Contact your sales Office.

2.3 *Response & QE curves*

2.3.1 Quantum Efficiency

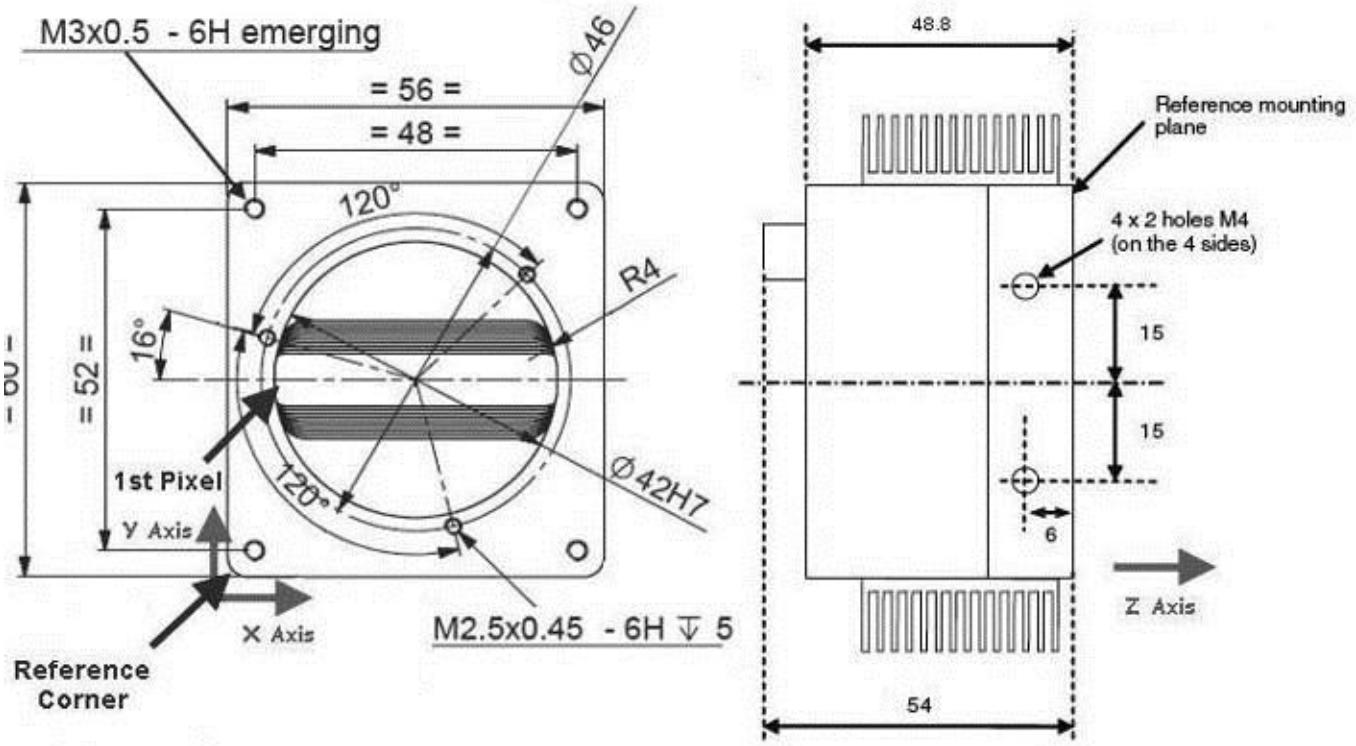


2.3.2 Spectral Response

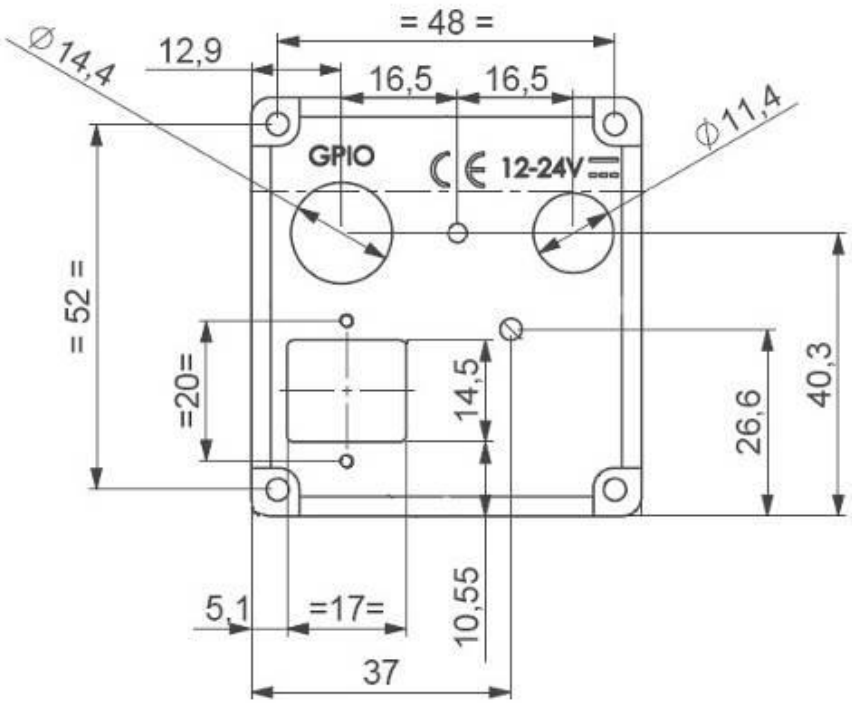


3 CAMERA HARDWARE INTERFACE

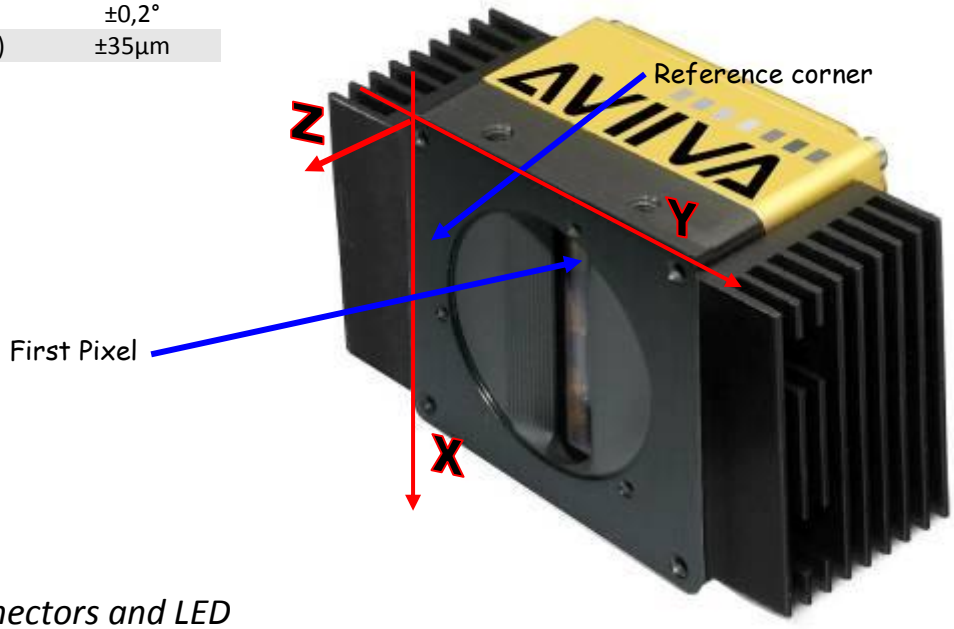
3.1 Mechanical Drawings



Note: All dimensions are in millimeters



Sensor alignment	
Z = -10.3	±150µm
4k 10µm : X = 7.52mm 2k 14µm : X = 13.66mm 1k 14µm : X = 20.83mm 512 14µm : X = 24.41mm	±100 µm
Y = 30mm	±100 µm
Planarity	±35 µm
Rotation (X,Y plan)	±0,2°
Tilt (versus lens mounting plane)	±35µm



3.2 *Input/output Connectors and LED*

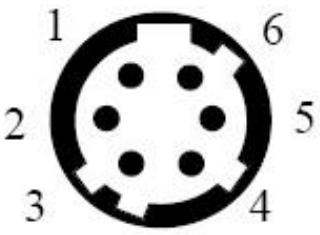
Status LED Behaviour

After less than 2 seconds of power establishment, the LED first lights up in ORANGE. Then after a Maximum of 30 seconds, the LED must turn in a following colour :

Colour and state	Meaning
Green and continuous	OK
Green and blinking slowly	Waiting for Ext Trig (Trig1 and/or Trig2)
Red and continuous	Camera out of order : Internal firmware error
Orange and continuous	Initialisation phase

3.2.1 Power Connector

Camera connector type: **ACCA 6119** (male)
Cable connector type: **ACCA CR01A-P6S-S** (female)



Camera side description

Signal	Pin	Signal	Pin
PWR	1	GND	4
PWR	2	GND	5
PWR	3	GND	6

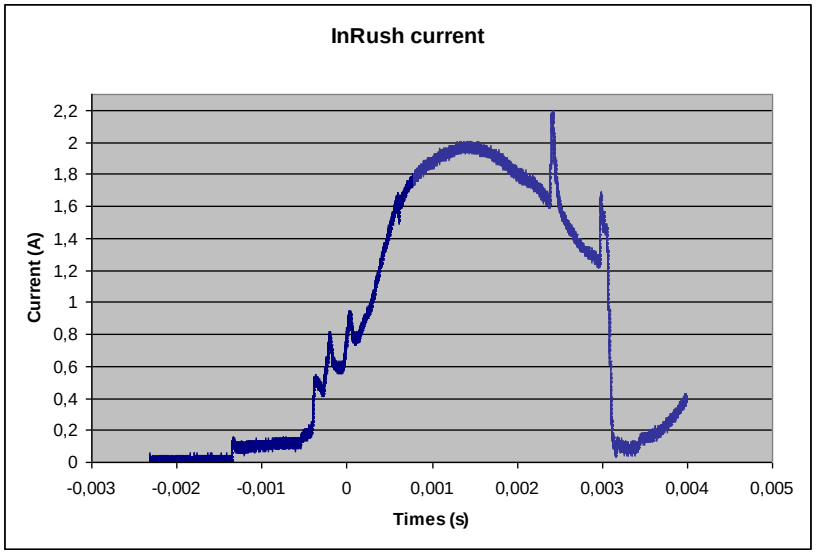
Power supply from 12 to 24v
Power 11W max with an typical inrush current peak of **2,2A** during power up

Typical values	Current consumption	
Camera	**12V**	**24V**
EM1 0.5kx14µm	0.75A	0.37A
EM1 1kx14µm	0.80A	0.40A
EM1 2kx10µm	0,73A	0,39A
EM1 2kx14µm	0,79A	0,42A
EM1 4kx10µm	0,81A	0,43A

In standby mode at 24V :

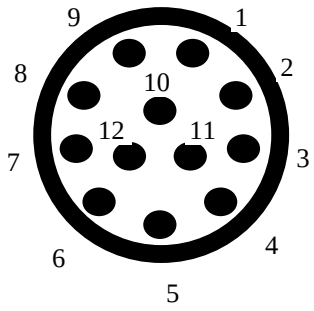
- Power = around **5W**
- Current = **0,208A**

Power up Time : Around 40s



3.2.2 GPIO Connector

Camera Connector type: Hirose HR10A-10R-12SB
Cable Connector type: Hirose HR10A-10R-12P
Cable type: cable immune from interference and with twisted pairs

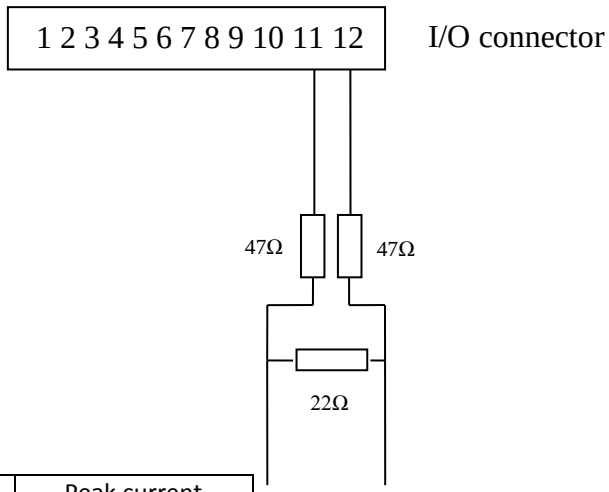


Camera side description

Signal	Pin	Signal	Pin
Line0-	1	Line3+	7
Line0+	2	Line1-	8
Line2-	3	Line1+	9
Line2+	4	GND	10
GND	5	Line4-	11
Line3-	6	Line4+	12

EM1 camera has a flexible I/O block :
- Signals from Input or Output can be inverted with **LineInverter** feature
- Signals from Input can be debounced with **LineDebouncer** feature. The debounce filter allows holding signal transitions for 0.7 µs period. During this period further transitions will be ignored.
- Input and Output can be driven by TTL, LVDS or RS422 signal type and switched just with a selection on **LineFormat** feature.

For Input in TTLmode, connect on positive pin (Line0**+**, Line1**+** or Line2**+)** and Ground.
For Input in LVDS, connect on the pair pins (Line0+/Line0-, Line1+/Line1-, Line2+/Line2-)
For Output in TTL mode, connect on positive pin (Line3**+** or Line4**+)** and Ground.
For Output in LVDS mode, add three resistors as shown on the schema below at the end of the output line:



- **Absolute maximum rating of I/O block** :

	Minimum voltage	Maximum voltage	Peak current
Outputs	-12V	+15V	180mA
Input	-7V	+12V	?

3.2.3 Giga Ethernet Output

Camera connector type: RJ45 8pin female
Cable connector type: RJ45 8pin male
Cable type: cable immune from interference of Cat.6 with a maximum length of 100 meters in order to have best performances. (For short distance, a cat.5E cable can be used.)

- **Ethernet connection** :

Pin	Signal	Pin	Signal
1	MDI_0+	5	MDI_2-
2	MDI_0-	6	MDI_1-
3	MDI_1+	7	MDI_3+
4	MDI_2+	8	MDI_3-

EM1 camera works only with a transfer rate of 1Gbit/s in full duplex mode.

4 STANDARD CONFORMITY

The AVIIVA EM1 cameras have been tested using the following equipment:

- A shielded power supply cable
- An Ethernet Cable cat6

e2v recommends using the same configuration to ensure the compliance with the following standards.

4.1 CE Conformity

The AVIIVA EM1 cameras comply with the requirements of the EMC (European) directive 2004/108/CE (EN50081-2, EN 61000-6-2).

This device is a class A device. Operation of this equipment in a residential area is likely to cause harmful interference. In this case the user will be required to correct the interference at his own expense.

4.2 FCC Conformity

The AVIIVA EM1 cameras further comply with Part 15 of the FCC rules, which states that:

Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation

This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

4.3 RoHs Conformity

AVIIVA EM1 cameras comply with the requirements of the RoHS directive 2002/95/EC.

5 GETTING STARTED

5.1.1 Out of the box

The contains of the Camera box is the following :

There is no CDROM delivered with the Camera : This User Manual , but also the Pleora PureGeV Package, DemoGeV and all documentation associated to the GigE Vision, GenICam standards can be downloaded from the web site : This ensure you to have an up-to-date version.

*Main Camera page : **www.e2v.com/cameras***

On the appropriate Camera Page (EM1) you'll find a download link

first version of CommCam compliant is indicated in the last Chapter

PureGeV package and its documentation requires a login/password :

- *Login : **pleora***
- *Password : **vercors***

5.2 *Setting up in the system*

Vocabulary :

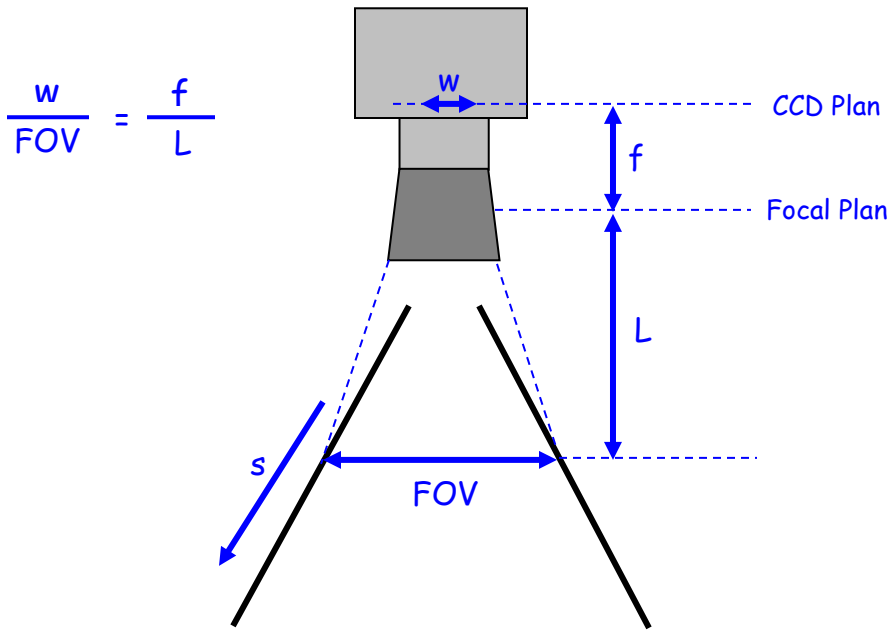
w = size of the sensor line (40,96mm for the 4k 10µm)
FOV = Field Of View (width of the web inspected by the sensor line) in mm.
L = Working distance (from the Lens to the Web) in mm.
f = focal distance of the lens in mm.
S = Speed of the web in mm/s

We have : w/FOV = f/L

The ratio M = w/FOV is called Magnification.
The FOV is grabbed by 4096 or 2048 pixels in the width.
In order to get a ratio of 1 :1 in your image, at the web speed of S, your line rate has to be set :
Line Rate = (S/FOV) x 4096 (or 2048)

Ex : if the FOV = 11 cm (110mm) and the speed of the web is S= 0,3 m/s (300mm/s) the line rate will be :
Line Rate = (300 /110) x 4096 = 11170 Lines/s.

If you use a 60mm lens, the working distance will be : L = (60 x 110) / 40,96 = 161mm.
This will certainly require a macro lens.



6 CAMERA SOFTWARE INTERFACE

6.1 GigE Vision concepts

Camera interface is compliant with "Gigabit Ethernet Vision" (GigE Vision) or (GEV). GEV normalizes image transport and camera control communications over usual IP networks. Physical GEV carrier has a bandwidth of one gigabit per second (1Gbit/s). GEV is widely used by camera manufacturers and imaging software suppliers.

6.1.1 GenICam

Camera interface is compliant with "Generic Interface for Cameras" (GenICam).
GenICam normalizes the camera control interface with software application. The target is to have a single application controlling cameras from any model and brand the same way.
It introduces the concept of user manual, not for humans but to software application. Application reads this user manual to control cameras.
GenICam has 2 parts, "GenICam Standard" and "GenICam Standard Features Naming Convention" (SFNC)

6.1.2 GenICam Standard

It normalizes the camera control rules. It can be considered as the grammar of the user manual.
From programmer's point of view, all cameras are controlled with the same way by a single Software Developer's Kit (SDK).

6.1.3 SFNC

From vision point of view, camera feature names are standardized by SFNC. It can be considered as the vocabulary of the user manual. The SNFC 1.3 is available in the documentation pack of this Camera : You'll find all the complementary details which could miss you in this manual.

6.2 *Getting started with GigE Vision interface*

This chapter shows how to connect a GEV camera for the first time.

6.2.1 Network setup

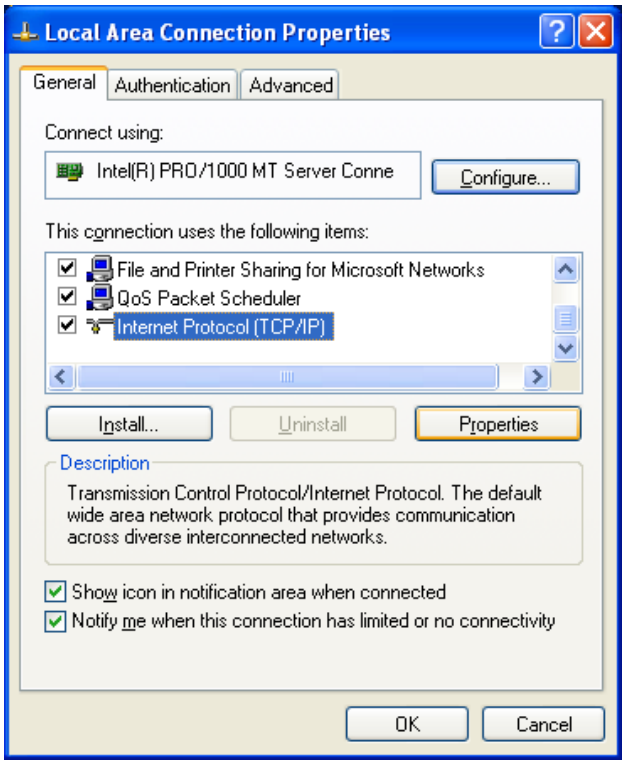
The following is the simplest example of a Gigabit IP network.

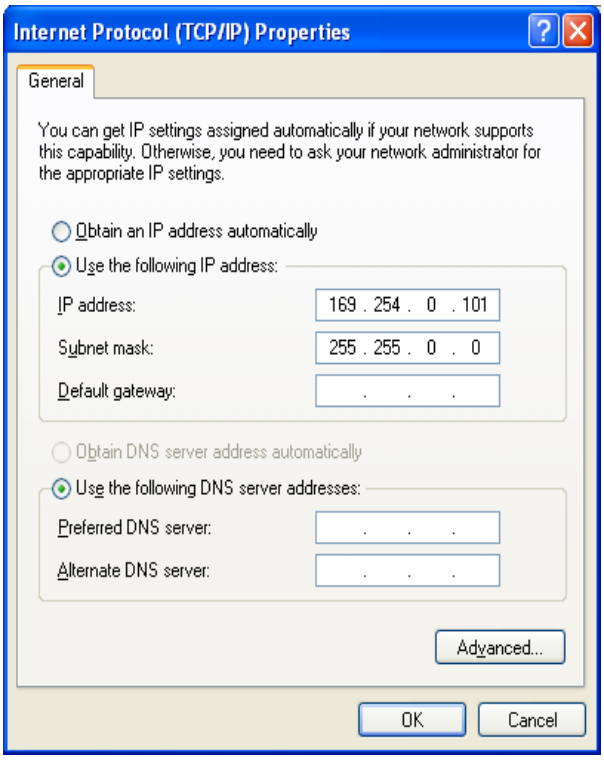
A single Ethernet cable is connected in RJ45 receptacles of GEV camera and PC. Select a "CAT6" shielded twisted pair quality to get a reliable 1Gbit/s. This cable is available at any computer shop. Recent PC have a gigabit RJG45 plug on the motherboard.

Factory setup has set the camera to the default IP subnet 169.254.X.X. The PC interface is set to this default IP subnet as follows:

Open the Network interface properties. Settings are shown on Windows XP.

Set TCP-IP v4 interface properties to IP address 169.254.0.101 and subnet mask to 255.255.0.0





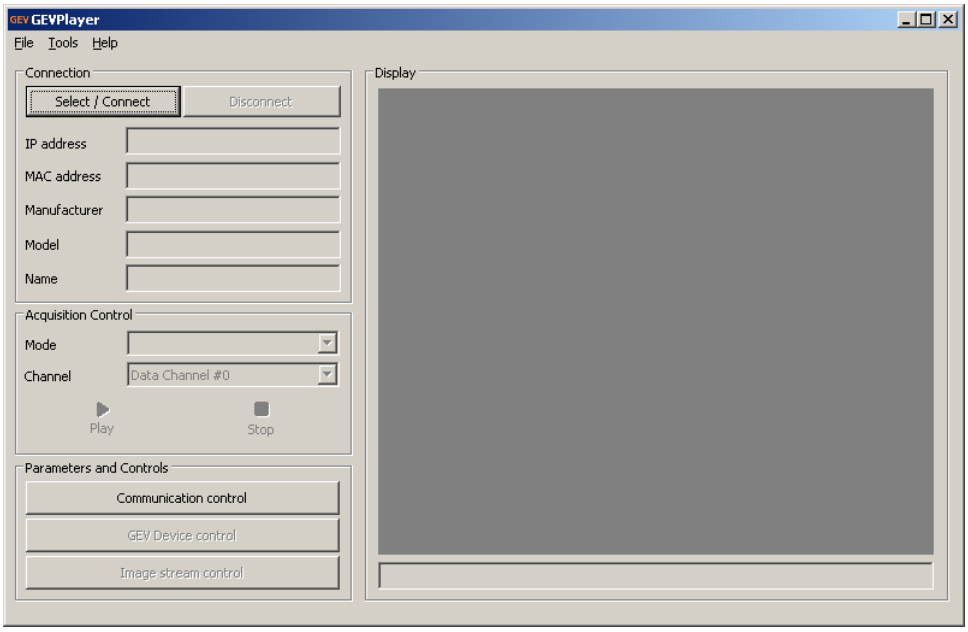
6.2.2 Software installation

A GigE Vision software is required. Use your own or install PureGEV, downloadable from www.e2v.com/cameras site. A PureGEV license is included in camera package. Refer to PureGEV installation manual for instructions. The following assumes Pleora's PureGEV is installed.

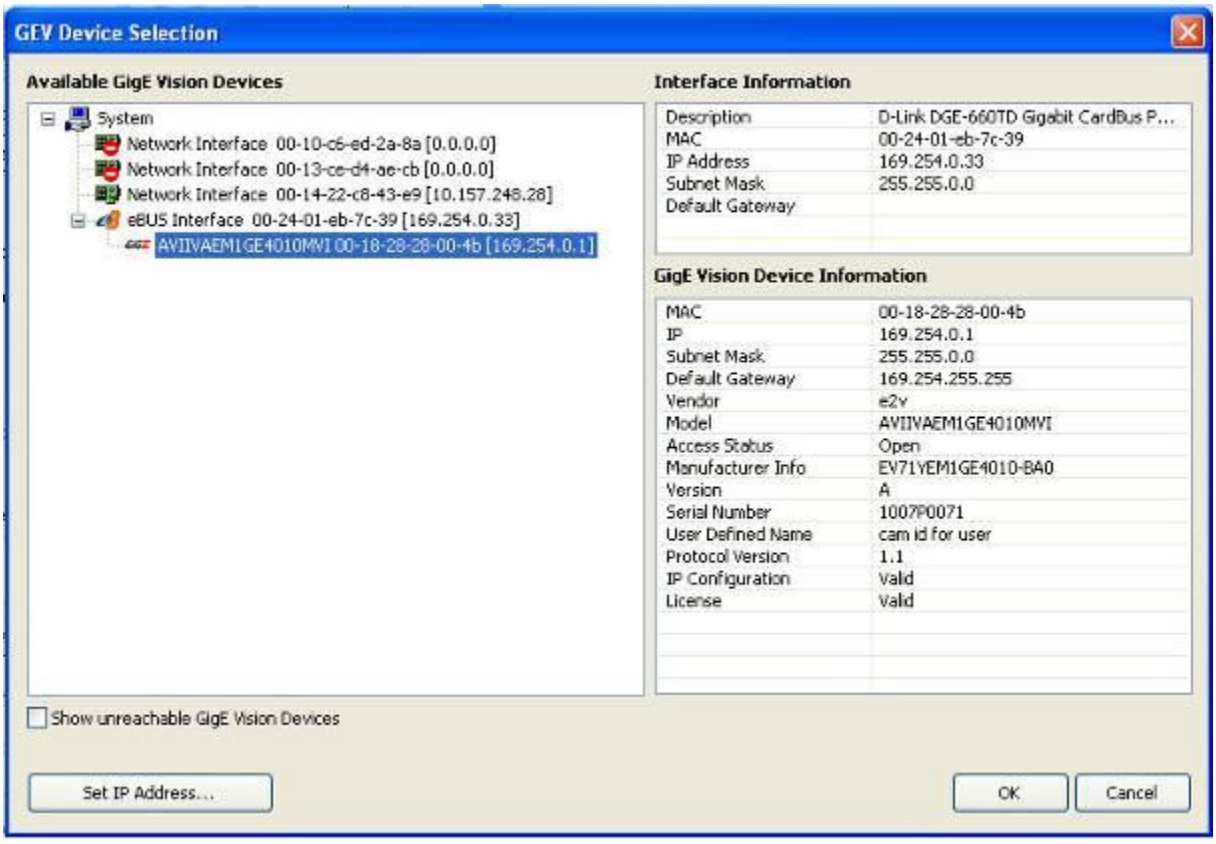
To keep things simple, the firewall should be temporary turned off.

6.2.3 Interactive camera control

PureGEV Player is used to control camera interactively and display images :



"Select / Connect" button opens the GEV Device Selection window. GigE cameras appears.

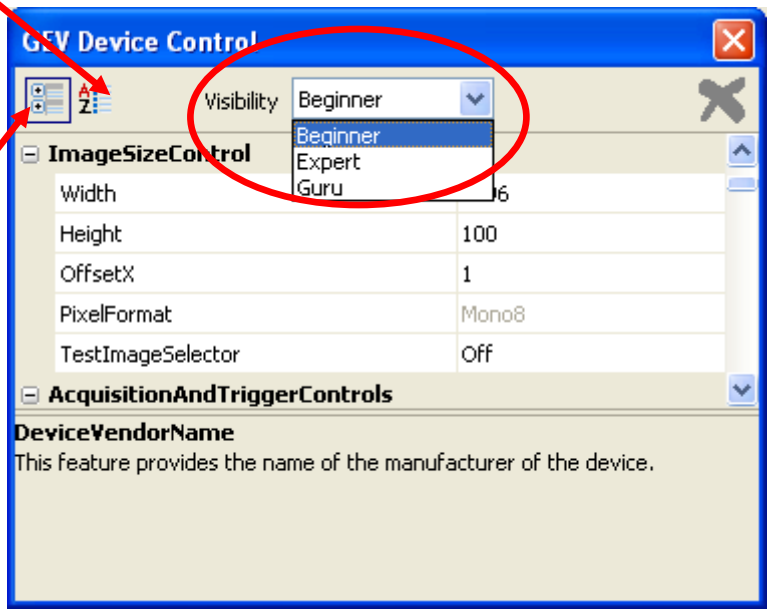


Click on camera and check "License" value is "Valid" and click OK. In GEV Player window, "Gev Device control" and "Play" are now active.

Once connected to the Camera you have an easy access to all its features when you click on “GEV DeviceControl”. The visibility of these features can be associated to three types of users: Beginner, Expert or Guru. Then you can make life easy for simple users.

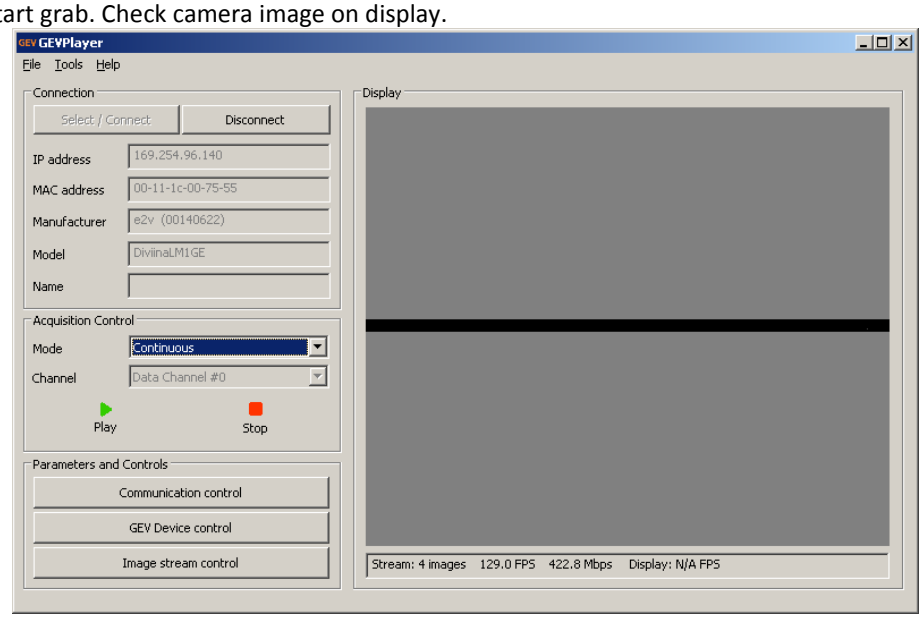
Set Features alphabetically

Set Features inside several items

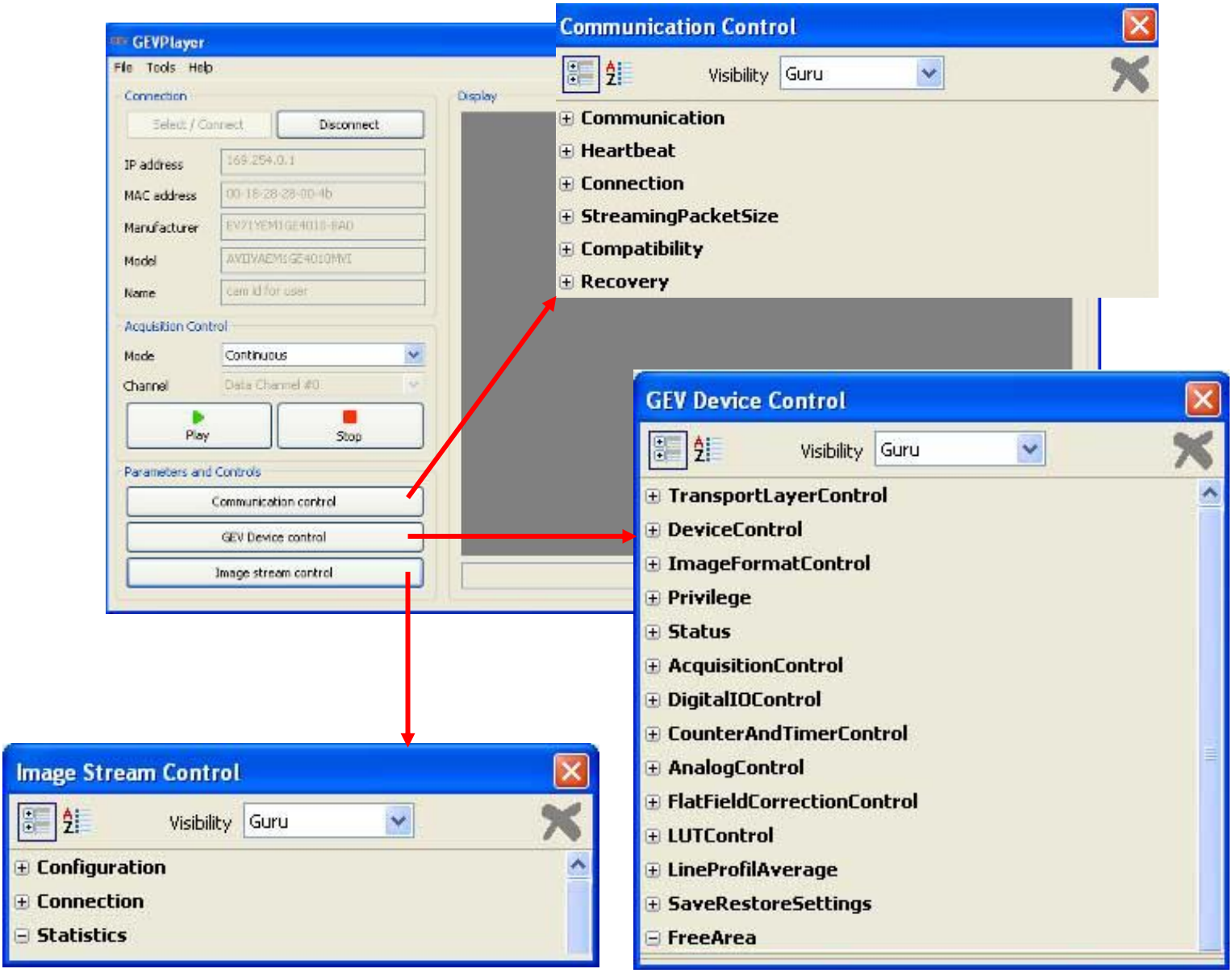


Beginner : The number of features with “Beginner ” visibility should be limited to all basics features of the device, and easy to use.
Expert : features that require a more in-depth knowledge of the camera functionality. This is the preferred visibility level for all advance features in the camera**.**
Guru : Advanced feature that might bring the camera into a state where it will not work properly anymore if it is set incorrectly for the current mode operation.

Click "Play" to start grab. Check camera image on display.



6.3 Camera Commands



In the following Chapters, you will find the details of the GEV Device Control Menu, relative to the Camera configuration. The Image Stream Control and Communication Control menus are dedicated to GeVPlayer configuration and are explained in the corresponding documentation.

6.3.1 How to Read the Tables of Parameters below?

Format / Color hierarchy in the Parameter Tables

Standard Parameters :

They use the following Font of Characters :

GevDeviceModeCharacterSet

Type : IInteger, IBoolean, ICommand, IString, IFloat …

Specific Type : IEnumeration

GevCCP

OpenAccess
ExclusiveAccess **=> List of Possible values**
ControlAccess

Access : R = Read Only, R/W = Read/Write

Visibility : B=Beginner, E=Expert, G=Guru

Selection Parameters :

The value set in this Parameter (or the selection in the List) decides for a new branch of Parameters.

The Font of Characters used is the same as ***standard*** but ***underlined***. The new branch of parameters which depends from this value is listed after and the Font of Characters is in ***Blue***. Then the "Blue" Parameter attribution depends on the underlined parameter setting

Example with the Gain settings :

Two parameters :

GainSelector

AnalogAll
All
DigitalTap1
DigitalTap2
DigitalTap3
DigitalTap4
DigitalAll

Gain

Are equivalent to the Seven following Parameters :

Gain = "AnalogAll Gain Value" (Preamp Gain setting)
Gain = "All Gain Value" (Amp Gain setting)
Gain = "DigitalTap1 Gain Value" (Gain Tap1 setting)
Gain = "DigitalTap2 Gain Value" (Gain Tap2 setting)
Gain = "DigitalTap3 Gain Value" (Gain Tap3 setting)
Gain = "DigitalTap4 Gain Value" (Gain Tap4 setting)
Gain = "DigitalAll Gain Value" (Digital Gain setting)

The contextual parameters (in ***Blue***) can have all the same type of the standard ones (IInteger …)

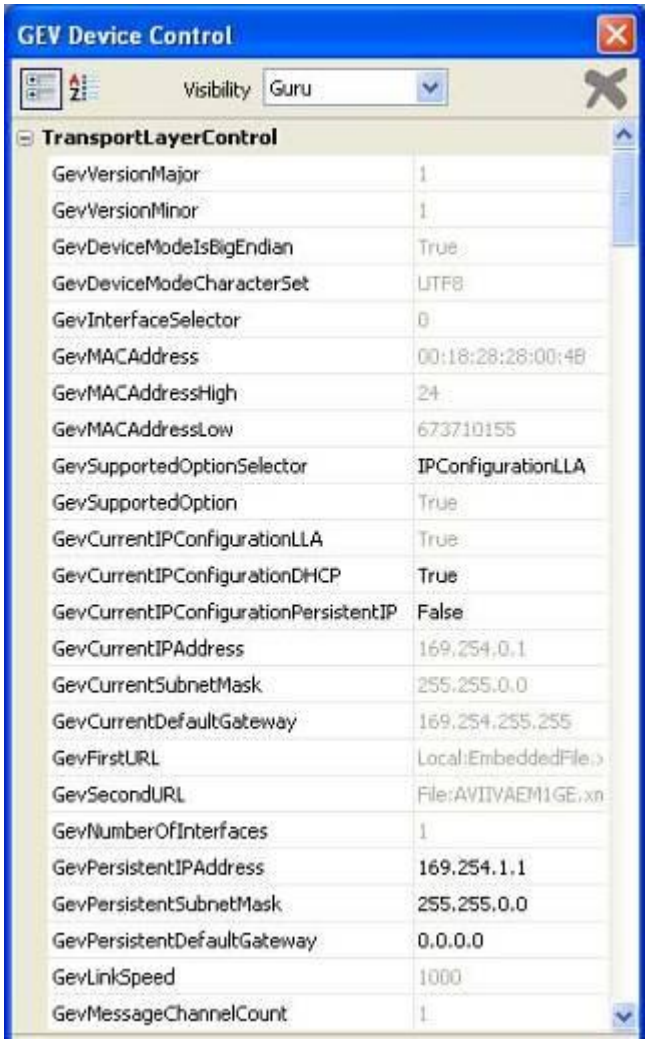
6.3.2 TransportLayerControl

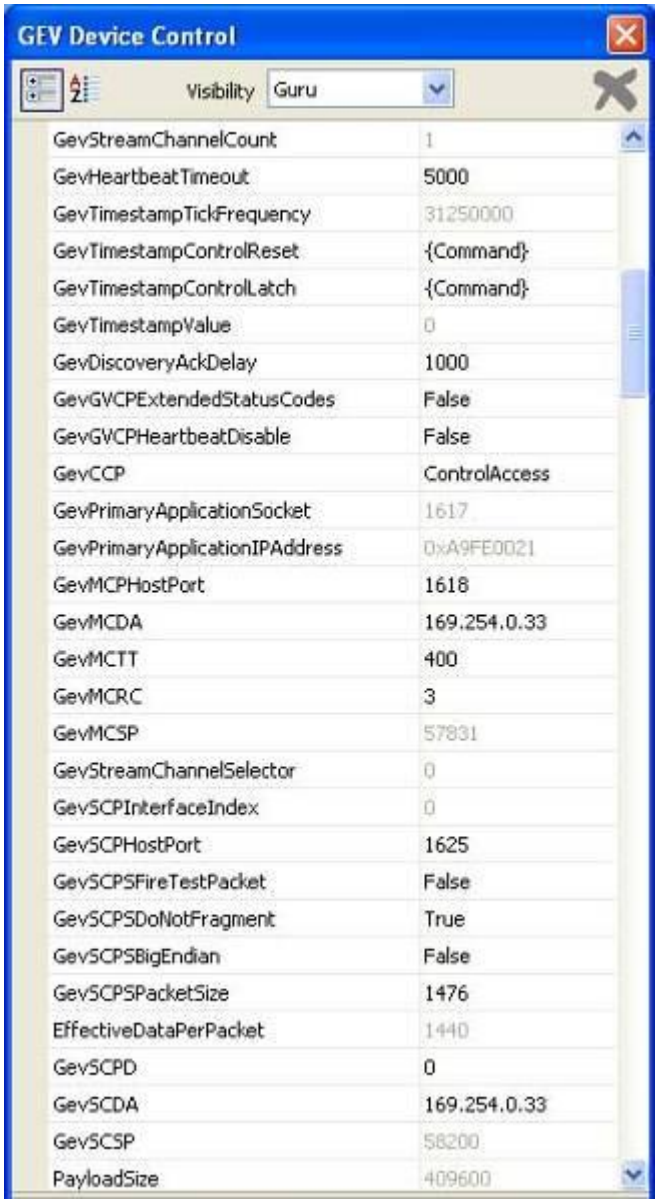
This section provides the Transport Layer control features.

This category lists the features necessary to access GigE Vision bootstrap registers and other information related to the GigE Vision transport medium. Note most of these registers are mapped according to GigE Vision specification.

More information about exact meaning of these features is found in the GigE Vision specification. All GigE Vision features start with the “Gev” prefix.

GigE Vision registers are 32-bit. If a GigE Vision register has multiple fields within this 32-bit, then they are separated in multiple features.





Name	Interface	Access	Visibility	Description
GevVersionMajor	IInteger	R	E	Major version of the specification.
GevVersionMinor	IInteger	R	E	Minor version of the specification.
GevDeviceModeIsBigEndian	IBoolean	R	G	Endianess of the device registers.
GevDeviceModeCharacterSet	IEnumeration	R	G	Character set used by all the strings of the bootstrap registers.
GevInterfaceSelector	IInteger	R	B	Selects which physical network interface to control : **Always 0 as only one network is available**
GevMACAddress	IInteger	R	B	MAC address of the network interface.
GevMACAddressHigh	IInteger	R	B	High part of the MAC address of the network interface.
GevMACAddressLow	IInteger	R	B	Low part of the MAC address of the network interface.
GevCurrentIPConfigurationLLA	IBoolean	R/W	B	Indicates if Link Local Address IP configuration scheme is activated on the given network interface.
GevCurrentIPConfigurationDHCP	IBoolean	R/W	B	Indicates if DHCP IP configuration scheme is activated on the given network interface.
GevCurrentIPConfigurationPersistentIP	IBoolean	R/W	B	Indicates if PersistentIP configuration scheme is activated on the given network interface.
GevCurrentIPAddress	IInteger	R	B	Reports the IP address for the given network interface.
GevCurrentSubnetMask	IInteger	R	B	Provides the subnet mask of the given interface.
GevCurrentDefaultGateway	IInteger	R	B	Indicates the default gateway IP address to be used on the given network interface.
GevPersistentIPAddress	IInteger	R/W	B	Indicates the Persistent IP address for this network interface.
GevPersistentSubnetMask	IInteger	R/W	B	Indicates the Persistent subnet mask associated with the Persistent IP address on this network interface.
GevPersistentDefaultGateway	IInteger	R/W	B	Indicates the persistent default gateway for this network interface.
GevLinkSpeed	IInteger	R	E	Indicates the speed of transmission negotiated by the given network Interface in MBytes/s

Name	Interface	Access	Visibility	Description
GevSupportedOptionSelector IPConfigurationLLA IPConfigurationDHCP IPConfigurationPersistentIP CommandsConcatenation WriteMem PacketResend Event EventData PendingAck Action ExtendedStatusCodes DiscoveryAckDelayWritable DiscoveryAckDelay TestData ManifestTable CCPApplicationSocket LinkSpeed HeartbeatDisable SerialNumber UserDefinedName StreamChannelSourceSocket MessageChannelSourceSocket	IEnumeration	R/W	E	Selects the GEV option to interrogate for existing support. Answer is given in GevSupportedOption
GevSupportedOption	IBoolean	R	E	Returns if the selected GEV option is supported.
GevFirstURL	IString	R	G	Indicates the first URL to the XML device description file.
GevSecondURL	IString	R	G	Indicates the second URL to the XML device description file.
GevNumberOfInterfaces	IInteger	R	E	Indicates the number of physical network interfaces supported by this device.
GevMessageChannelCount	IInteger	R	E	Indicates the number of message channels supported by this device.
GevStreamChannelCount	IInteger	R	E	Indicates the number of stream channels supported by this device.
GevHeartbeatTimeout	IInteger	R/W	G	Indicates the current heartbeat timeout in milliseconds.
GevTimestampTickFrequency	IInteger	R	E	Indicates the number of timestamp ticks during 1 second (frequency in Hz).
GevTimestampControlReset	ICommand	W	E	Resets the Timestamp counter to 0.
GevTimestampControlLatch	ICommand	W	E	Latches current timestamp counter into GevTimestampValue.
GevTimestampValue	IInteger	R	E	Returns the latched 64-bit value of the timestamp counter.
GevDiscoveryAckDelay	IInteger	R/(W)	E	Indicates the maximum randomized delay the device will wait to acknowledge a discovery command in ms
GevGVCPExtendedStatusCodes	IBoolean	R/W	G	Enables genereation of extended status codes.
GevGVCPHeartbeatDisable	IBoolean	R/W	E	Disables the GVCP heartbeat.

Name	Interface	Access	Visibility	Description
GevCCP OpenAccess ExclusiveAccess ControlAccess	IEnumeration	R/W	G	Controls the device access privilege of an application.
GevPrimaryApplicationSocket	IInteger	R	G	Returns the UDP source port of the primary application.
GevPrimaryApplicationIPAddress	IInteger	R	G	Returns the address of the primary application.
GevMCPHostPort	IInteger	R/W	G	Indicates the port to which the device must send messages.
GevMCDA	IInteger	R/W	G	Indicates the destination IP address for the message channel.
GevMCTT	IInteger	R/W	G	Provides the transmission timeout value in milliseconds.
GevMCRC	IInteger	R/W	G	Indicates the number of retransmissions allowed when a message channel message times out.
GevMCSP	IInteger	R	G	This feature indicates the source port for the message channel.
GevStreamChannelSelector	IInteger	R	E	Selects the stream channel to control. **Always 0 as only one stream channel available.**
GevSCPInterfaceIndex	IInteger	R	G	Index of network interface to use **Always 0 as only one network available.**
GevSCPHostPort	IInteger	R/W	G	Indicates the port to which the device must send data stream.
GevSCPSFireTestPacket	IBoolean	R/W	G	Sends a test packet.
GevSCPSDoNotFragment	IBoolean	R/W	G	The state of this feature is copied into the "do not fragment" bit of IP header of each stream packet.
GevSCPSBigEndian	IBoolean	R/W	G	Endianess of multi-byte pixel data for this stream.
GevSCPSPacketSize	IInteger	R/W	E	Specifies the stream packet size in bytes to send on this channel.
GevSCPD	IInteger	R/W	E	Indicates the delay (in timestamp counter unit) to insert between each packet for this stream channel.
GevSCDA	IInteger	R/W	G	Indicates the destination IP address for this stream channel.
GevSCSP	IInteger	R	G	Indicates the source port of the stream channel.
PayloadSize	IInteger	R	E	Provides the number of bytes transferred for each image or chunk on the stream channel in Bytes

Note : If the user has configured the camera front end, he can read from the back end which PayloadSize will be transferred for each image. This number covers all kind of data coming with the image, e.g. stamps etc. If the user allocates PayloadSize for each buffer he is insured that each frame will fit into his target buffers.

6.3.3 DeviceControl

Device control features provides general information and control for the device (camera) and its sensor. This is mainly used to identify the device during the enumeration process and to obtain information about the sensor resolution. Other information and controls pertaining to the general state of the device are also included in this category.

Name	Interface	Access	Visibility	Description
DeviceVendorName	IString	R	B	Name of the manufacturer of the device.
DeviceModelName	IString	R	B	Model of the device.
DeviceManufacturerInfo	IString	R	B	Manufacturer information about the device.
DeviceID	IString	R	E	Device identifier (serial number).
DeviceVersion	IString	R	B	Version of the device.
DeviceFirmwareVersion	IString	R	B	Version of the firmware in the device.
DeviceUserID	IString	R/W	B	User-programmable device identifier.
ElectronicBoardID	IString	R	B	Electronic Board ID (**NON SFNC**)
DeviceScanType LineScan	IEnumeration	R	E	Scan type of the sensor. **LineScan Only**
DeviceMaxThroughput	IInteger	R	E	Maximum bandwidth of the data that can be streamed out of the device in Byte/s
DeviceRegistersCheck	ICommand	(R)/W	E	Perform the validation of the current register set for consistency.
DeviceRegistersValid	IBoolean	R	E	Returns if the current register set is valid and consistent.

6.3.4 ImageFormatControl

This section describes how to influence and determine the image size and format. It also provides the necessary information to acquire and to display the image data. The sensor provides ***SensorWidth*** time ***SensorHeight*** pixels.
Note : The image outputted is necessary with a ***Width*** of ***SensorWidth*** as there is no Region of interest available.

The ***Height*** parameter will give you the number of lines grabbed for each image.
As some reception buffers are required on the Application side, the size of each of these buffers is defined by :

Width x ***Heigth x PixelFormat***

Each pixel in the image has a format defined by ***PixelFormat*** which fix both ***PixelSize*** and ***PixelCoding***

Name	Interface	Access	Visibility	Description
SensorWidth	IInteger	R	E	Effective width of the sensor in pixels.
SensorHeight	IInteger	R	E	Effective height of the sensor in pixels.
WidthMax	IInteger	R	E	Maximum width (in pixels) of the image.
HeightMax	IInteger	R	E	Maximum height (in pixels) of the image.
Width	IInteger	R	B	Width of the Image provided by the device sensor (in pixels).
Height	IInteger	R/W	B	Height of the image provided by the device (in pixels).
PixelCoding Mono MonoPacked	IEnumeration	R/(W)	E	Coding of the pixels in the image. Depends on PixelFormat.
PixelSize Bpp8 Bpp12	IEnumeration	R/(W)	E	Total size in bits of a pixel of the image. Depends on PixelFormat.
PixelColorFilter	IEnumeration	R	E	Type of color filter that is applied to the image. **Always None**
PixelFormat Mono8 Mono12	IEnumeration	R/W	B	Format of the pixel to use for acquisition.

Name	Interface	Access	Visibility	Description
TestImageSelector Off GrayHorizontalRamp GrayDiagonalRampMoving	IEnumeration	R/W	B	Selects the type of test image that is sent by the camera.
EnableEndOfLineData	IBoolean	R/W	B	Enable the addition of 2 x 32bits data at the end of each line
EnableEndOfLineData0Source Counter1 Counter2 Timer1 Timer2	IEnumeration	R/W	B	Selects the source of first data of 32 to put at the end of each line
EnableEndOfLineData1Source Counter1 Counter2 Timer1 Timer2	IEnumeration	R/W	B	Selects the source of second data of 32 to put at the end of each line

- **TestImageSelector** : The GrayHorizontalRamp (test patterns) are different depending on the ***PixelFormat*** and the ***SensorSize***. They are defined in details Appendix A of this document.

- **EndOfLineData** : The User can put 2 words of 32bits each in addition at the end of each pixel line data. These words can be designed as the output of the two Counters or the two timers.

6.3.5 Privilege (Non SFNC)

There are 3 privilege levels for the camera :

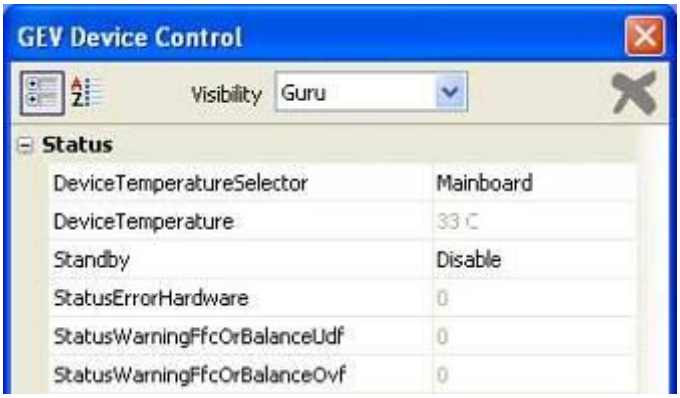
- Factory (0) : Reserved for the Factory
- Integrator (1) : Reserved for system integrators
- User (2) : For all Users.

The Cameras are delivered in Integrator mode. They can be locked in User mode and a specific password is required to switch back the Camera in Integrator mode. This password can be generated with a specific tool available from the hotline (hotline-cam@e2v.com)

None of these parameters and Section are defined with the SNFC.

Name	Interface	Access	Visibility	Description
CameraPrivilegeLevel IntegratorMode UserMode	IEnumeration	R	E	Current Privilege Level. **NON SFNC**
ChangePrivilegeLevel	IInteger	R/W	E	Input code to change privilege. **NON SFNC**

6.3.6 Status (Non SFNC)



This section doesn't exist in the SFNC. Except the ***DeviceTemperature*** features (usually defined in the DeviceControl Section), the other features are not defined also in the SFNC

The ***StatusErrorHardware*** is global for the Camera
The ***StatusWarnings*** are common for FFC and Tap Balance Processes.

The StandBy mode is an unique feature from the AVIIVA EMx series.

Name	Interface	Access	Visibility	Description
DeviceTemperatureSelector MainBoard	IEnumeration	R	E	Select the temp sensor location.
DeviceTemperature	IInteger	R	E	Temperature measured
Standby	IBoolean	R/W	E	Enable/Disable the Standby mode **NON SFNC**
StatusErrorHardware	IInteger	R	E	Status bit for an Hardware error **NON SFNC**
StatusWarningFfcOrBalanceUdf	IBoolean	R	E	Warning for Underflow after FFC or Balance **NON SFNC**
StatusWarningFfcOrBalanceOvf	IBoolean	R	E	Warning for Overflow after FFC or Balance **NON SFNC**

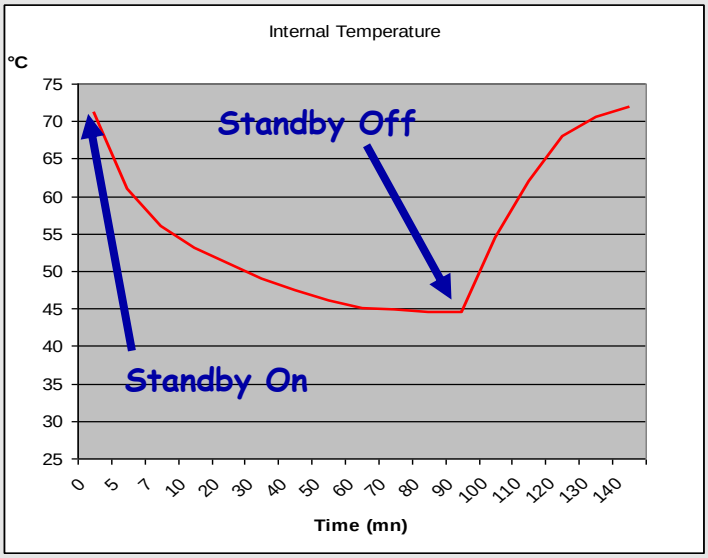
- ***DeviceTemperature :***
  Return by the camera : Temperature in Q10.2 format (8 bits signed + 2 bits below comma). Value is between -512 to 511 in °C.

  The temperature Sensor is placed on the CCD driver Board, close to the Sensor itself.
  The Temperature displayed is one of the highest possible in the Camera. Then it can be monitored to activate the standby mode, in case of too high temperature (see insert below)
  The limits are always referenced by the internal temperature sensor. (**cf APPENDIX B : Thermal Management**)

A standby mode, what for ?

The Standby mode stops all activity on the sensor level. The power dissipation drops down to less than 5W. During the standby mode, the Camera carry on sending black images through the CameraLink outputs in order to avoid any disruption in the application system.

Once the Standby mode turned off, the Camera recovers in less than **1ms** to send images again from the sensor.
But it's necessary to grab an image of about 100 lines because these first lines after the Sensor Power down don't have a correct level (due to the re-establishment of the black reference level.



6.3.7

6.3.8 AcquisitionControl

The Acquisition Control section describes all features related to image acquisition, including the trigger and exposure control. It describes the basic model for acquisition and the typical behavior of the device.

An **Acquisition** is defined as the capture of a sequence of one or many **Frame**(s)

A **Frame** is defined as the capture of **Width** pixels x **Height** lines.
A **Line** starts with an optional **Exposure** period and ends with the completion of the sensor read out..

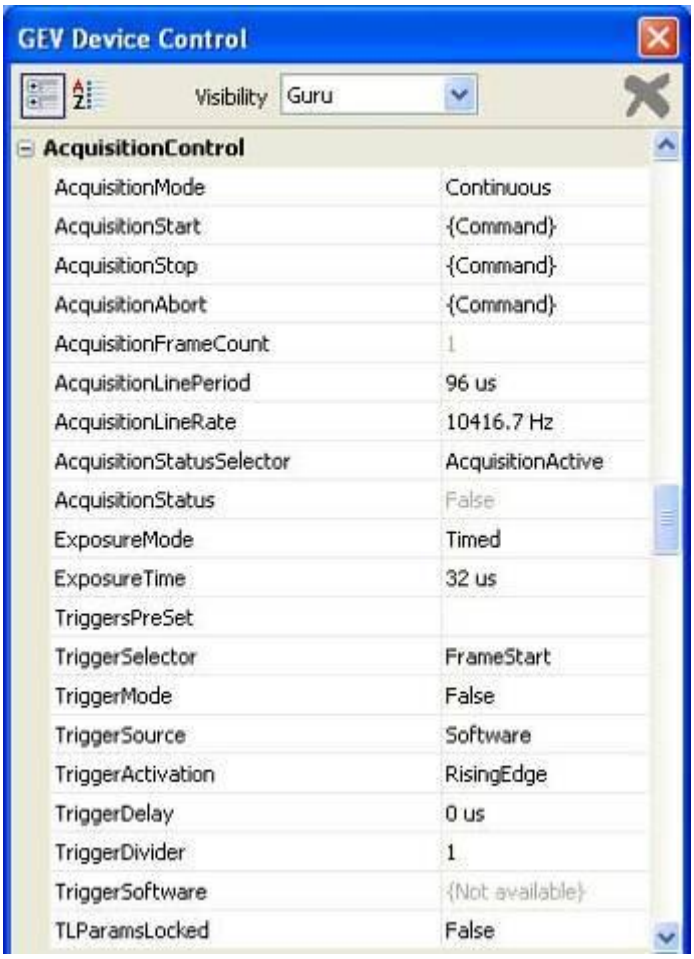
The **AcquisitionMode** controls the mode of acquisition for the device. This mainly affects the number of frames captured in the Acquisition (**SingleFrame, MultiFrame, Continuous**).

The **AcquisitionStart** command is used to start the Acquisition.

The **AcquisitionStop** command will stop the Acquisition at the end of the current Frame**.** It can be used in any acquisition mode and if the camera is waiting for a trigger, the pending Frame will be cancelled.

The **AcquisitionAbort** command can be used to abort an Acquisition at any time. This will end the capture immediately without completing the current Frame.

AcquisitionFrameCount controls the number of frames that will be captured when
AcquisitionMode is **MultiFrame**.



AcquisitionLinePeriod controls the period of each Line. The **AcquisitionLineRate** is calculated from this value.

AcquisitionStatusSelector and **AcquisitionStatus** can be used to read the status of the internal acquisition signals. The standard acquisition signals Status are: **AcquisitionTriggerWait, AcquisitionActive, FrameTriggerWait, FrameActive,**

Name	Interface	Access	Visibility	Description
AcquisitionMode SingleFrame MultiFrame Continuous	IEnumeration	R/W	B	Sets the acquisition mode of the device.
AcquisitionStart	ICommand	(R)/W	B	Starts the Acquisition of the device.
AcquisitionStop	ICommand	(R)/W	B	Stops the Acquisition of the device at the end of the current Frame.
AcquisitionAbort	ICommand	(R)/W	E	Aborts the acquisition immediately.
AcquisitionFrameCount	IInteger	R/W	B	Number of frames to acquire in MultiFrame Acquisition mode.
AcquisitionLinePeriod	IFloat	R/W	B	Controls the line period (in µs)
AcquisitionLineRate	IFloat	R/W	B	Gives the equivalent line rate (in Hertz)
AcquisitionStatusSelector AcquisitionTriggerWait AcquisitionActive FrameTriggerWait FrameActive	IEnumeration	R/W	E	Selects the internal acquisition signal to read using AcquisitionStatus.
AcquisitionStatus	IBoolean	R	E	Reads the state of the internal acquisition signal selected using AcquisitionStatusSelector.
ExposureMode Timed TriggerWidth TriggerControlled	IEnumeration	R/W	B	Selects the type of trigger to configure.
ExposureTime	IFloat	R/W	B	Sets the internal exposure time of the camera (in µs)
TriggerPreset ContinuousTimedMode TriggeredTimedMode TriggeredTimedModeWithFrameTrigger TriggeredWidthMode TriggeredWidthModeWithFrameTrigger ITCMaxMode ITCMaxModeWithFrameTrigger ITCMode ITCModeWithFrameTrigger	IEnumeration	R/W	B	**NON SFNC** Sets automatically the camera in a list of Pre-selected Trigger modes equivalent to the existing CameraLink versions of e2v Cameras. See below for details of each mode.

Name	Interface	Access	Visibility	Description
TriggerSelector AcquisitionStart AcquisitionEnd AcquisitionActive FrameStart FrameEnd FrameActive ExposureStart ExposureEnd ExposureActive	IEnumeration	R/W	B	Selects the type of trigger to configure.
TriggerMode Off On	IEnumeration	R/W	B	Controls if the selected trigger is active.
TriggerSource Line0 Line1 Line2, Timer1End Timer2End Counter1End Counter2End UserOutput0 UserOutput1 UserOutput2 UserOutput3 UserOutput4	IEnumeration	R/W	B	Specifies the internal signal or physical input Line to use as the trigger source.
TriggerActivation RisingEdge FallingEdge AnyEdge LevelHigh LevelLow	IEnumeration	R/W	B	Specifies the activation mode of the trigger.
TriggerDelay	IFloat	R/W	B	Specifies the delay in microseconds (us) to apply after the trigger reception before activating it.
TriggerDivider	IInteger	R/W	B	Specifies a division factor for the incoming trigger pulses.
TriggerSoftware	ICommand	R/W	B	**Not available**
TLParamsLocked	IBoolean	R/W	B	

6.3.8.1 Trigger Presets

Some synchronization modes are defined as preset in the Camera (***TriggerPreset***, Non SFNC Parameter).
When selecting one of these Preset, the Camera sets automatically a list of parameters in the corresponding position to be in accordance with the mode defined as below :

- **ContinuousTimedMode**
  - Line Period defined by Acquisition Line Period feature.
  - Exposure time defined with Exposure Time feature.

Parameter	Value
AcquisitionMode	Continuous
ExposureMode	Timed
TriggerSelector	"All values"
TriggerMode	Off

- **TriggeredTimedMode**
  - Exposure started upon the rising edge of the Line 0 trigger.
  - Exposure time defined with Exposure Time feature.

Parameter	Value
AcquisitionMode	Continuous
ExposureMode	Timed
TriggerSelector	"All values"
TriggerMode	Off
TriggerSelector	ExposureStart
TriggerMode	On
TriggerSource	Line0
TriggerActivation	RisingEdge

- **TriggeredTimedModeWithFrameTrigger**
  - Exposure started upon the rising edge of the Line 0 trigger.
  - Exposure time defined with Exposure Time feature.
  - Frame started with Line 2 trigger

Parameter	Value
AcquisitionMode	Continuous
ExposureMode	Timed
TriggerSelector	"All values"
TriggerMode	Off
TriggerSelector	FrameActive
TriggerMode	On
TriggerSource	Line2
TriggerActivation	LevelHigh
TriggerSelector	ExposureStart
TriggerMode	On
TriggerSource	Line0
TriggerActivation	RisingEdge

- **TriggeredWidthMode**
  - Exposure started upon Line 0 trigger.
  - Exposure time defined with Line0 trigger width

Parameter	Value
AcquisitionMode	Continuous
ExposureMode	TriggerWidth
TriggerSelector	"All values"
TriggerMode	Off
TriggerSelector	ExposureActive
TriggerMode	On
TriggerSource	Line0
TriggerActivation	LevelHigh

- **TriggeredWidthModeWithFrameTrigger**
  - Exposure started upon Line 0 trigger.
  - Exposure time defined with Line0 trigger width.
  - The Frame is valid on the high level of the Line 2 trigger

Parameter	Value
AcquisitionMode	Continuous
ExposureMode	TriggerWidth
TriggerSelector	"All values"
TriggerMode	Off
TriggerSelector	FrameActive
TriggerMode	On
TriggerSource	Line2
TriggerActivation	LevelHigh
TriggerSelector	ExposureActive
TriggerMode	On
TriggerSource	Line0
TriggerActivation	LevelHigh

- **ITCMaxMode**
  - Exposure started upon Timer1End.
  - Exposure ended upon Line0 trigger

Parameter	Value
AcquisitionMode	Continuous
ExposureMode	TriggerControlled
TriggerSelector	"All values"
TriggerMode	Off
TriggerSelector	ExposureStart
TriggerMode	On
TriggerSource	Timer1End
TriggerActivation	RisingEdge
TriggerSelector	ExposureEnd
TriggerMode	On
TriggerSource	Line0
TriggerActivation	RisingEdge
TimerSelector	Timer1
TimerTriggerSource	Line0
TimerTriggerActivation	RisingEdge
TimerDelayAbs	0
TimerDurationAbs	1

The Timer1 is set to be equivalent to the readout time

- **ITCMaxModeWithFrameTrigger**
  - Exposure started upon Timer1End.
  - Exposure ended upon Line0 trigger.
  - The Frame is valid on the high level of the Line 2 trigger

Parameter	Value
AcquisitionMode	Continuous
ExposureMode	TriggerControlled
TriggerSelector	"All values"
TriggerMode	Off
TriggerSelector	FrameActive
TriggerMode	On
TriggerSource	Line2
TriggerActivation	LevelHigh
TriggerSelector	ExposureStart
TriggerMode	On
TriggerSource	Timer1End
TriggerActivation	RisingEdge
TriggerSelector	ExposureEnd
TriggerMode	On
TriggerSource	Line0
TriggerActivation	RisingEdge
TimerSelector	Timer1
TimerTriggerSource	Line0
TimerTriggerActivation	RisingEdge
TimerDelayAbs	0
TimerDurationAbs	1

- **ITCMode**
  - Exposure started upon Line 0 trigger.
  - Exposure ended upon Line1 trigger

Parameter	Value
AcquisitionMode	Continuous
ExposureMode	TriggerControlled
TriggerSelector	"All values"
TriggerMode	Off
TriggerSelector	ExposureStart
TriggerMode	On
TriggerSource	Line0
TriggerActivation	RisingEdge
TriggerSelector	ExposureEnd
TriggerMode	On
TriggerSource	Line1
TriggerActivation	RisingEdge

- **ITCModeWithFrameTrigger**
  - Exposure started upon Line 0 trigger.
  - Exposure ended upon Line1 trigger.
  - The Frame is valid on the high level of the Line 2 trigger

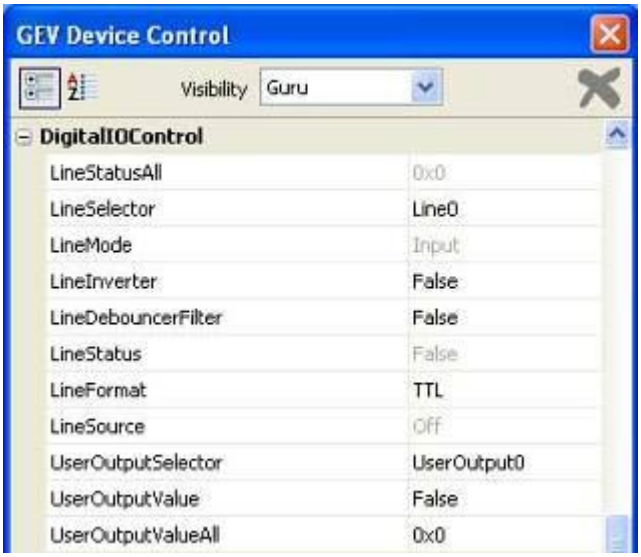
Parameter	Value
AcquisitionMode	Continuous
ExposureMode	TriggerControlled
TriggerSelector	"All values"
TriggerMode	Off
TriggerSelector	FrameActive
TriggerMode	On
TriggerSource	Line2
TriggerActivation	LevelHigh
TriggerSelector	ExposureStart
TriggerMode	On
TriggerSource	Line0
TriggerActivation	RisingEdge
TriggerSelector	ExposureEnd
TriggerMode	On
TriggerSource	Line1
TriggerActivation	RisingEdge

In any preset mode using a trigger: if the trigger source is no more active the AcquisitionAbort feature is required to switch back to the Continuous Timed mode

6.3.9 DigitalIOControl

Digital I/O covers the features required to control the general Input and Output signals of the camera. This includes Input and output control signals for Triggers Timers, counters and also static signals such as User configurable input or output bits.

The Digital I/O Control section models each I/O **Line** as a physical line that comes from the device connector and that goes into an **I/O Control Block** permitting to condition and to monitor the incoming or outgoing **Signal**.



Name	Interface	Access	Visibility	Description
LineStatusAll	IInteger	R	E	Returns the current status of all available Line signals at time of polling in a single bitfield.
LineSelector Line0 Line1 Line2 Line3 Line4	IEnumeration	R/W	E	Selects the physical line (or pin) of the external device connector to configure.
LineMode Line0 : Input Line1 : Input Line2 : Input Line3 : Output Line4 : Output	IEnumeration	R	E	Indicates if the physical Line is used to Input or Output a signal.
LineInverter	IBoolean	R/W	E	Controls the invertion of the signal of the selected input or output Line.
LineDebounceFilter	IBoolean	R/W	E	Activates the Internal debounce filter of the selected input line. The debounce filtering time is fixed at about 0.7µs.
LineStatus	IBoolean	R	E	Returns the current status of the selected input or output Line.
LineFormat TTL LVDS RS422	IEnumeration	R/W	E	Controls the current electrical format of the selected physical input or output Line.

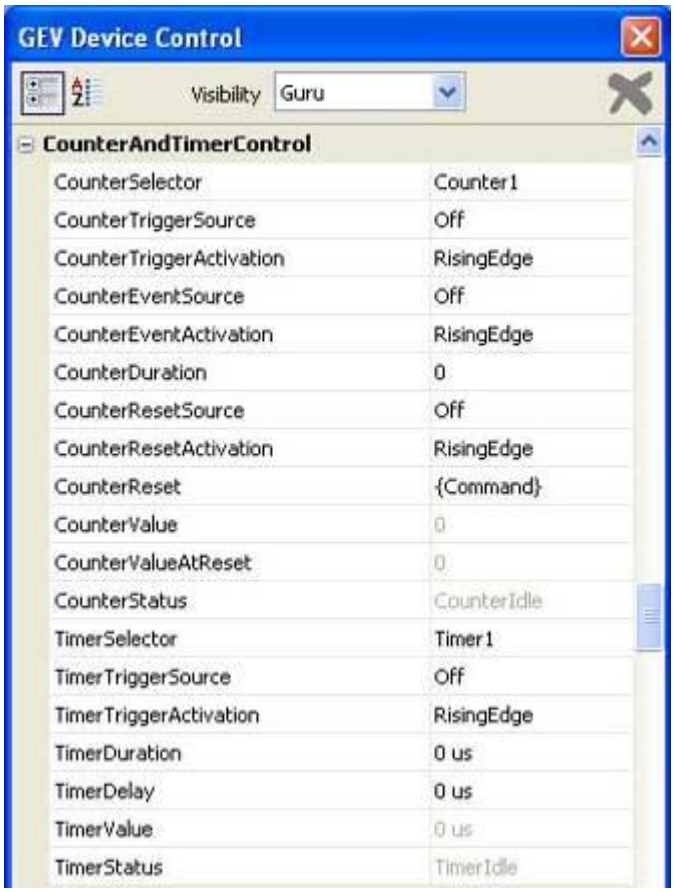
Name	Interface	Access	Visibility	Description
LineSource Off AcquisitionTriggerWait AcquisitionActive FrameTriggerWait FrameActive ExposureActive Timer1Active Timer2Active Counter1Active, Counter2Active UserOutput0 UserOutput1 UserOutput2 UserOutput3 UserOutput4 MissedTrigger	IEnumeration	R/W	E	Selects which internal acquisition or I/O source signal to output on the selected Line.
UserOutputSelector UserOutput0 UserOutput1 UserOutput2 UserOutput3 UserOutput4	IEnumeration	R/W	E	Selects which bit of the User Output register will be set by UserOutputValue.
UserOutputValue	IBoolean	R/W	E	Sets the value of the bit selected by UserOutputSelector.
UserOutputValueAll	IInteger	R/W	E	Sets the value of all the bits of the User Output register.
UserOutputValueAllMask	IInteger	R/W	E	Sets the write mask to apply to the value specified by UserOutputValueAll before writing it in the User Output register.

6.3.10 CounterAndTimerControl

This section lists all features that relates to control and monitoring of Counters and Timers.
A Counter is used to count internal events (FrameStart, FrameTrigger, …), I/O external events (Input Line rising edge, …) and even clock ticks. It can be Reset or Read at anytime. Counters and Timers can also be cascaded to increase their range if necessary.

Timers are readable and can be used to measure the duration of internal or external signals. A Timer can also be used to generate a timed strobe pulse with an optional delay before activation.
In AVIIVA EM1 camera, 2 x Counters and 2 x Timers are available and are used in different applications:

- A Counter is used to count internal events. Ex: number of frame trigger, number of line started…
- A timer is used to measure the duration from an event. Ex: starts the Frame Acquisition 200µs after the reception of a Frame Trigger.



- **Counter** :

To start counter there are several possibilities:

- There is no condition to start the counter (**CounterTriggerSource = Off**), the counter increment each time the event occurs.
- There is a condition on the start of the counter: this condition has to be selected in the enumeration of the **CounterTriggerSource** feature and the activation with **CounterTriggerActivation** feature.

The counter stops incrementing if :

- The **CounterDuration** feature is equal to the CounterValue, even if a new event selected occur no new increment of the counter and no reset happened.
- A Reset happened either due to the **CounterReset** command (Enable with **CounterResetSource**=Software) or due to an external event happened on Inputs (Enable with **CounterTriggerSource** and **CounterTriggerActivation** features). If a new event happens the counter starts from 0 to count if condition of start is true.

Name	Interface	Access	Visibility	Description
CounterSelector Counter1 Counter2	IEnumeration	R/W	E	Selects which counter to configure.
CounterTriggerSource	IEnumeration	R/W	E	Selects the source to start the counter.
CounterTriggerActivation	IEnumeration	R/W	E	Selects the activation mode of the trigger to start the counter.
CounterEventSource Off AcquisitionStart AcquisitionEnd AcquisitionTrigger FrameStart FrameEnd FrameTrigger ExposureStart ExposureEnd Line0 Line1 Line2 Counter1End Counter2End Timer1End Timer2End TimeStampTick MissedTrigger	IEnumeration	R/W	E	Select the events that will be the source to increment the counter.
CounterEventActivation RisingEdge FallingEdge AnyEdge LevelHigh LevelLow	IEnumeration	R/W	E	Selects the Activation mode Event Source signal.
CounterDuration	IInteger	R/W	E	Sets the duration (or number of events) before the CounterEnd event is generated.
CounterResetSource Off Software Line0 Line1 Line2	IEnumeration	R/W	E	Selects the signals that will be the source to reset the counter.
CounterResetActivation RisingEdge FallingEdge AnyEdge LevelHigh LevelLow	IEnumeration	R/W	E	Selects the Activation mode counter Reset Source signal.
CounterReset	ICommand	(R)/W	E	Does a software reset of the selected counter.
CounterValue	IInteger	R/W	E	Reads or writes the current value of the selected counter.
Name	**Interface**	**Access**	**Visibility**	**Description**
CounterValueAtReset	IInteger	R	E	Reads the value of the selected counter when it was reset by a trigger or by an explicit CounterReset cmd.
CounterStatus	IEnumeration	R	E	Returns the current state of the counter.

CounterIdle CounterTriggerWait CounterActive CounterCompleted CounterOverflow				

- **Timer :**

The timer starts with the event occured on the selected list of **TimerTriggerSource** feature (type of activation selected by **TimerTriggerActivation** feature).
The adjustment of the timer is performed with **TimerDuration** (time before the generation of the event **TimerEnd)** and a **TimerDelay** (Delay before starting the duration value) features.
If it happens a new event (which is selected to start the timer) timer reset before restart the duration.

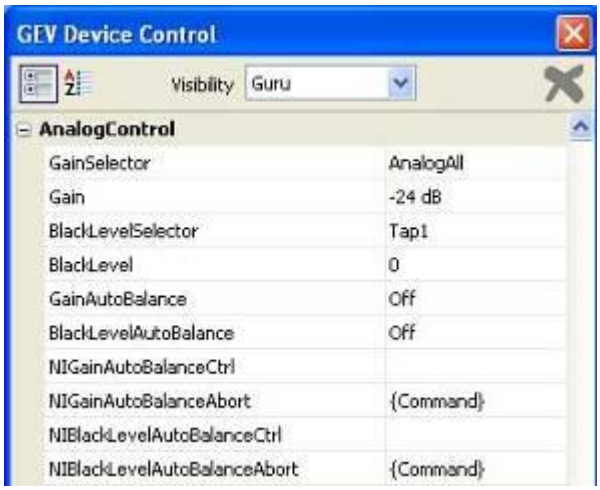
Name	Interface	Access	Visibility	Description
TimerSelector Timer1 Timer2	IEnumeration	R/W	E	Selects which Timer to configure.
TimerTriggerSource Off AcquisitionStart AcquisitionEnd AcquisitionTrigger FrameStart FrameEnd FrameTrigger ExposureStart ExposureEnd Line0 Line1 Line2 Counter1End Counter2End Timer1End Timer2End TimeStampTick MissedTrigger	IEnumeration	R/W	E	Selects the source of the trigger to start the Timer.
TimerTriggerActivation RisingEdge FallingEdge AnyEdge LevelHigh LevelLow	IEnumeration	R/W	E	Selects the activation mode of the trigger to start the Timer.
TimerDuration	IFloat	R/W	E	Sets the duration (in µs) of the Timer pulse.
TimerDelay	IFloat	R/W	E	Sets the duration (in µs) of the delay to apply at the reception of a trigger before to start the Timer.
Name	**Interface**	**Access**	**Visibility**	**Description**
TimerValue	IFloat	R/W	E	Reads or writes the current value (in µs) of the selected Timer.
TimerStatus TimerIdle TimerTriggerWait TimerActive	IEnumeration	R	E	Returns the current state of the Timer.

TimerCompleted				

6.3.11 AnalogControl

This section describes the features relative to the camera Gains and Offsets :

- Analog Gain
- Digital Gain and Offset
- Tap Balance (Gains and Offsets)



Name	Interface	Access	Visibility	Description
GainSelector AnalogAll All DigitalTap1 DigitalTap2 DigitalTap3 DigitalTap4 DigitalAll	IEnumeration	R/W	B	Selects which Gain is controlled by the various Gain features.
Gain	IFloat	R/W	B	Controls the selected gain as an absolute physical value.
BlackLevelSelector DigitalTap1 DigitalTap2 DigitalTap3 DigitalTap4 All	IEnumeration	R/W	E	Selects which Black Level is controlled by the various Black Level features.
BlackLevel	IFloat	R/W	E	Controls the analog black level as an absolute physical value.
GainAutoBalance	IEnumeration	R/W	B	Sets the mode for automatic gain balancing between the sensor taps.
BlackLevelAutoBalance	IEnumeration	R/W	B	Controls the mode for automatic black level balancing between the sensor taps.
NIGainAutoBalanceCtrl	ICommand	R/W	B	Same as GainAutoBalance but for NI (National Instruments) driver. Compatibility issue.
NIGainAutoBalanceAbort	ICommand	R/W	B	Abort for function GainAutoBalance only for NI driver.
NIBlackLevelAutoBalanceCtrl	ICommand	R/W	B	Same as BlackLevelAutoBalance but for NI (National Instruments) driver. Compatibility issue.
NIBlackLevelAutoBalanceAbort	ICommand	R/W	B	Abort for function BlackLevelAutoBalance only for NI driver.

Ultimate Concept: A different way to set the Gain in order to improve the Tap balance

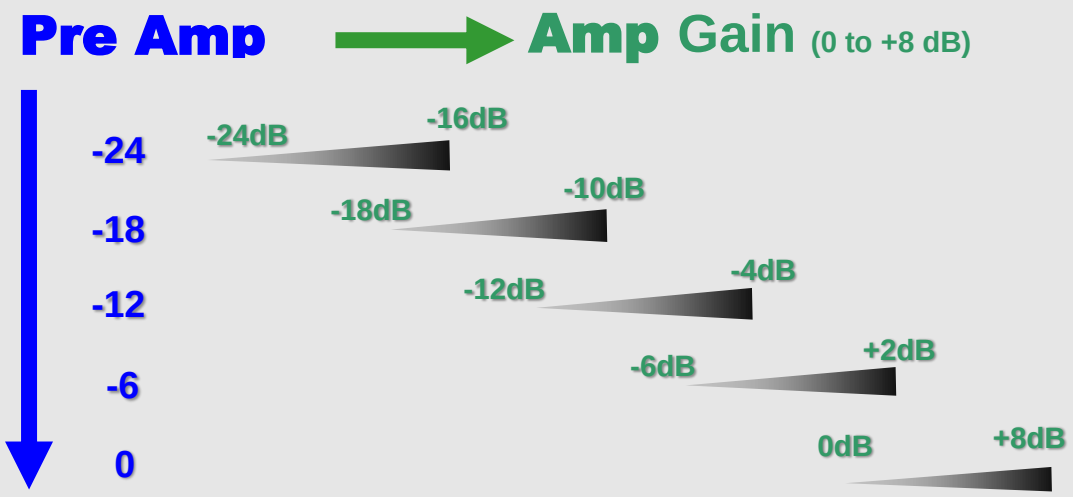
The "U" Concept has been developed to get a real improvement in term of tuning for the multi-Tap sensors :
As each sensor tap is driven by a different analog Chain, for an increasing of the global gain of the Camera, each tap can have a different behavior on its own Gain and offset.
This means that to be perfectly adjusted, a balance of the taps should be performed ideally after each change of the Gain. The Ultimate Concept offers a solution as following:

The Global analog Gain of the Camera is divided in 2 parts :

- A preamp-Gain which is composed of several steps (5 x steps of 6dB, from -24dB to 0dB on the AVIIVA EMx series)
- An amplification Gain with a continuous tuning (from 0dB to +8dB on the AVIIVA EMx series)

At each step of Preamp Gain, a Tap balance has been performed in factory for both Gains and Offsets and saved in ROM memory. When a new value of Preamp Gain is set, the factory settings of the both Gain and offset balance is automatically reloaded.
For sure, the user can also perform his own balance (automatically or manually) and can save it in one of the four dedicated memory banks.

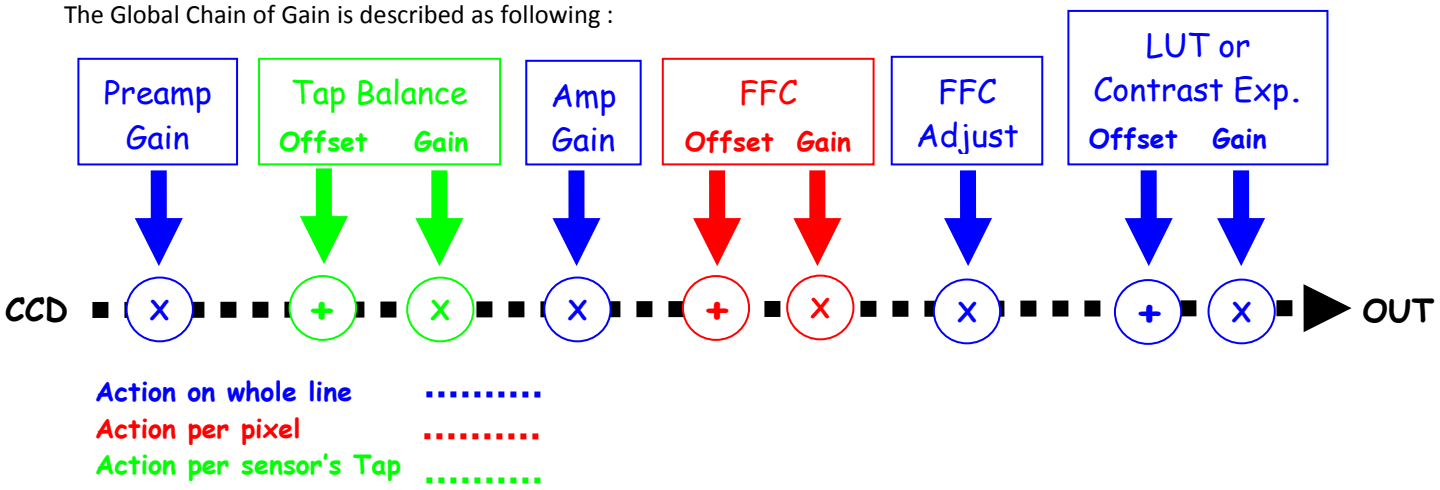
After the Preamp Gain level, the user can add more gain by using the Amplification Gain:



- The best tuning is when the Amplification Gain is set at its minimum possible
- Each change of Preamp Gain value loads automatically the associated values of the Tap balance (Gain and offset for each sensor tap).

This action takes more time than simply changing the Amplification Gain

The Global Chain of Gain is described as following :



6.3.11.1 Analog Gain

- **Preamp Gain** : (*GainAbs* with *GainSelector*= *AnalogAll*)
  The Preamp Gain is set by step of 6dB :
  - 0 : (-24dB)
  - 1 : (-18dB)
  - 2 : (-12dB)
  - 3 : (-6dB)
  - 4 : (0dB)

- **Gain:** (*GainAbs* with *GainSelector*= *All*)
  Value from 0 to 6193 corresponding to a Gain range of 0dB to +8dB calculated as following :
  Gain(dB) = 20.log(1+ Gain/4096).

6.3.11.2 Digital Gain & Offset (Contrast Expansion)

- **Digital Gain** (*GainAbs* with *GainSelector*=*DigitalAll*).
  Integer value from 0 to 255.
  The corresponding Gain is calculated as 20log(1+val/64) in dB

- **Digital Offset** (*BlackLevelRaw* with *BlackLevelSelector*=*All*)
  Value from –4096 to +4095 in LSB

The Contrast Expansion (both Digital Gain & Offset) will be automatically disabled if the LUT is enabled..

6.3.11.3 Tap Balance

How to perform a Tap Balance ?

Why and when performing a Tap Balance ?

Each output of the sensor (Tap) has its own analog Chain and behavior. There could have some discrepancies between these outputs in extreme conditions of Gain or temperature

The Tap balance is already performed in factory for each level of Preamp-Gain. If necessary, the Tap balance can be performed again by the User on both Offsets and Gains

The Procedure is the following :

Tap Balance by Offsets

- Cover the Lens of the camera to get a dark uniform target. This is not recommended to perform an Offset balance under light conditions.
- Launch the Tap Offset Balance
- The process takes a few seconds and can be interrupted when you want

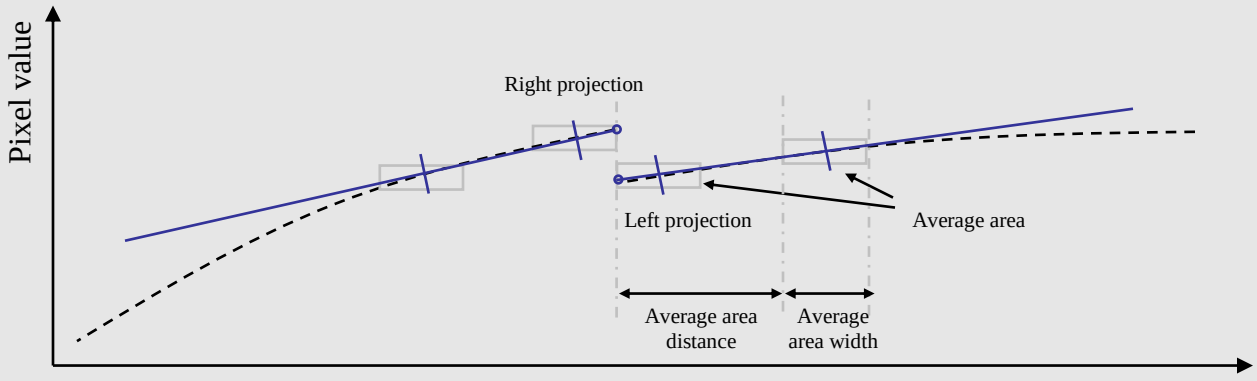
Tap Balance by Gains

- Provide an uniform light target to the camera : This is recommended to have a global level of around at least 70% of the saturation, otherwise, with a low light level (< 30% of the Saturation) the Gain has less effect than the Offset and your balancing won't be efficient.
- Launch the Tap Gain Balance
- The process takes a few seconds and can be interrupted when you want

- You can save the result in memory (result for both Gains and offsets).

Internal Process

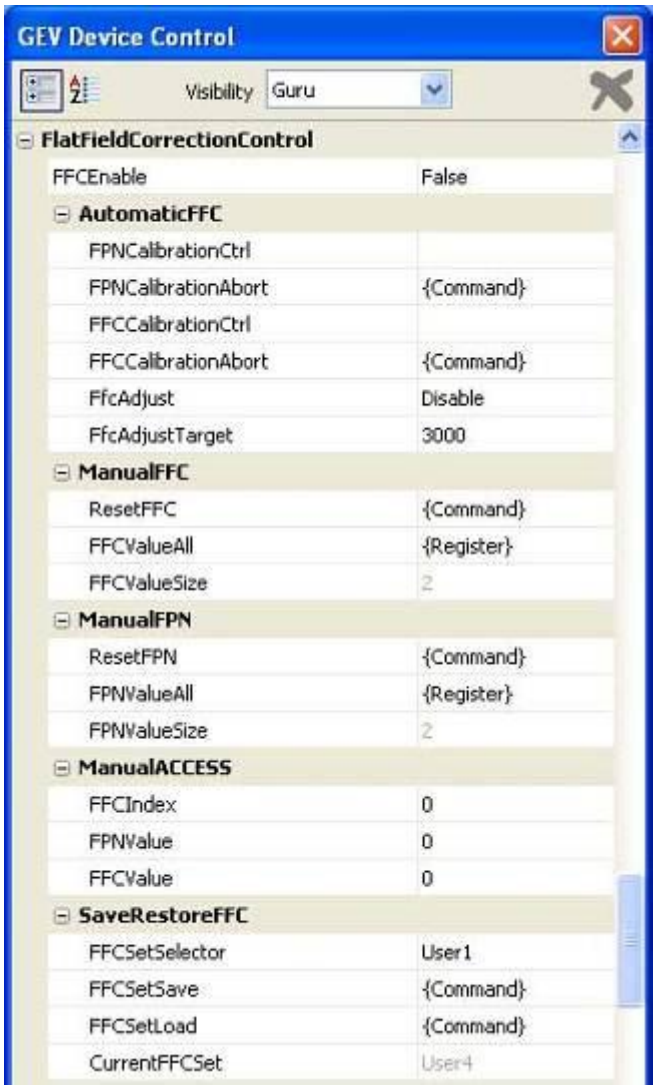
During the calibration process, the Camera calculates averages on some strategic ROIs (around the junction between taps) and then estimates the slope of the tangents and then the projections on each side of the junction.



The adjustment between these two neighbor taps is calculated to cancel the difference between the two projections (right and left).

6.3.12 FlatFieldCorrectionControl

All these features are out of the SFNC standard.
The functions are exactly the same as the EMx series in Cameralink interface.



Some Warnings can be issued from the PRNU/FPN Calibration Process as “pixel Overflow” or “Pixel Underflow” because some pixels have been detected as too high or too low in the source image to be corrected efficiently.
The Calculation result will be proposed anyway as it’s just a warning message.
The Status Register is changed and displayed in “Status” section (detailed chap §6.4.5)

Name	Interface	Access	Visibility	Description
FFCEnable	IBoolean	R/W	B	Enables or disables the current FFC
FPNCalibrationCtrl	ICommand	R/W	B	Starts the FPN (DSNU) calibration. The Camera must be in black and ready to grab (triggering active)
FPNCalibrationAbort	ICommand	R/W	B	Abort the running FPN Calibration Process
FFCCalibrationCtrl	ICommand	R/W	B	Starts the FFC (PRNU) calibration. The Camera must be in the non saturating and ready to grab (triggering active)
FFCCalibrationAbort	ICommand	R/W	B	Abort the running PRNU Calibration Process
FFCAdjust	IBoolean	R/W	B	Enables or disables the FFC Adjust function (see below)
FFCAdjustTarget	IInteger	R/W	B	Sets the Target value (in LSB 12bits) for the FFC Adjust function.
ResetFFC	ICommand	R/W	B	Reset all the current FFC (Gains) parameters.
FFCValueAll	IRegister	R/W	G	Accesses all the current FFC (Gains) coefficients in a single access without using individual FFCIndex.
FFCValueSize	IInteger	R	G	Indicates the size (in Bytes) of FFC (Gains) coefficients
ResetFPN	ICommand	R/W	B	Reset all the current FPN (Offsets) parameters.
FPNValueAll	IRegister	R/W	G	Accesses all the current FPN (Offsets) coefficients in a single access without using individual FFCIndex.
FPNValueSize	IInteger	R	G	Indicates the size (in Bytes) of FPN (Offsets) coefficients
FFCIndex	IInteger	R/W	G	Control the index (offset) of the coefficient to access in the current LUT
FPNValue	IFloat	R/W	G	Returns or set the FPN (Offset) Value at entry FFCIndex of the current FFC.
FFCValue	IFloat	R/W	G	Returns or set the PRNU (Gain) Value at entry FFCIndex of the current FFC.
FFCSetSelector User1 User2 User3 User4	IEnumeration	R/W	G	Selects the FFC memory to save/load .
FFCSetSave	ICommand	R/W	G	Save the current FFC
FFCSetLoad	ICommand	R/W	G	Load the FFC in the memory defined by FFCSelector in the current FFC.
CurrentFFCSet	IInteger	R	G	Indicates the last FFC memory has been Saved/loaded and is active

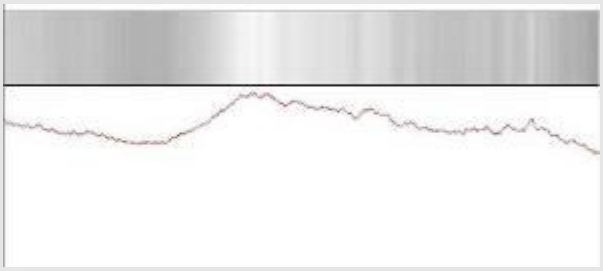
How is performed the Flat Field Correction ?

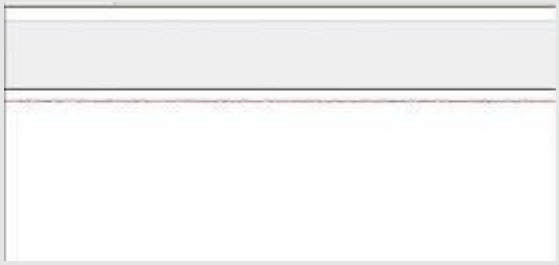
What is the Flat Field correction (FFC) ?

The Flat Field Correction is a digital correction on each pixel which allows :

- To correct the Pixel PRNU (Pixel Response Non Uniformity) and DSNU (Dark Signal Non Uniformity)
- To Correct the shading due to the lens
- To correct the Light source non uniformity

Before **After**





How is calculated / Applied the FFC ?

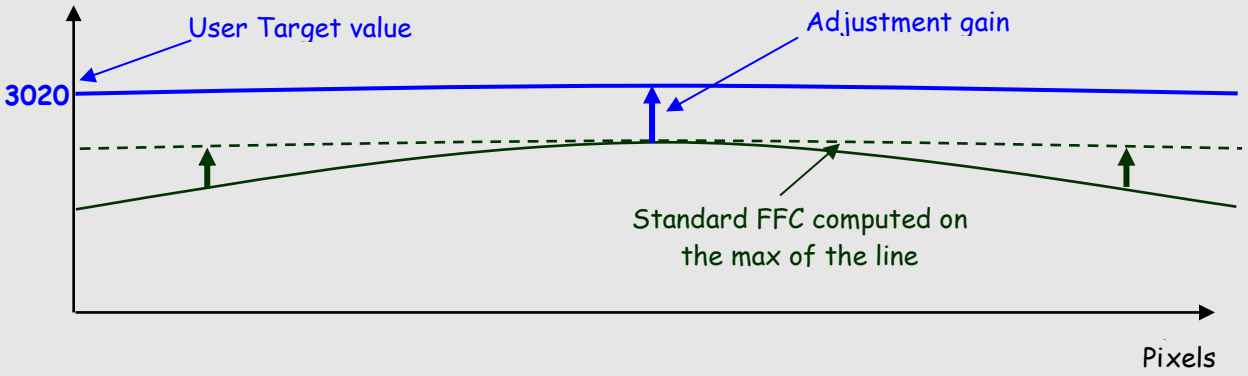
The FFC is a digital correction on the pixel level for both Gain and Offset.

- Each Pixel is corrected with :
  - An Offset on 8 bits (Signed Int 5.3). They cover a dynamic of ±16LSB in 12bits with a resolution of 1/8 LSB 12bits.
  - A Gain on 14 bits (Unsigned Int 14) with a max gain value of x3
  - The calculation of the new pixel value is : **P' = (P + Off).(1 + Gain/8192)**

The FFC processing can be completed with an automatic adjustment to a global target. This function is designed as "**FFC Adjust**". This adjustment to a User target is done by an internal hidden gain which is re-calculated each time the FFC is processed while the FFC adjust function is enabled.

The FFC is always processed with the max pixel value of the line as reference. If enabled, the FFC adjust module (located at the output of the FFC module) calculates the adjustment gain to reach the target defined by the User.

When the FFC result is saved in memory, the adjust gain and target are saved in the same time in order to associate this gain value with the FFC result.



How to perform the Flat Field Correction ?

FPN/DSNU Calibration

- Cover the lens
- Launch the FPN Calibration : Grab and calculation is performed in few seconds

PRNU Calibration

The User must propose a white/gray uniform target to the Camera (not a fixed paper).
The Gain/Light conditions must give a non saturated image in any Line.
The Camera must be set in the final conditions of Light/ Gain and in the final position in the System.
I f required, set a user target for the FFC adjust and enable it.

- White uniform (moving) target
- Launch the FFC
- Enable the FFC
- You can save the FFC result (both FPN+PRNU in the same time) in one of the 4 x FFC User Banks.
- The user target and Gain are saved with the associated FFC in the same memory.

Advices

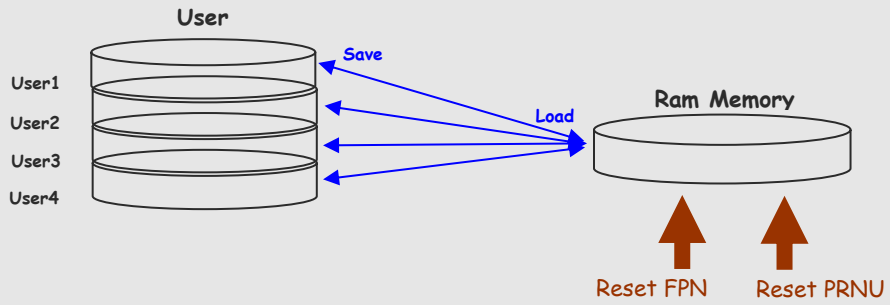
The AVIIVA EM1 Cameras have 4 x FFC Banks to save 4 x different FFC calibrations. You can use this feature if your system needs some different conditions of lightning and/or Gain because of the inspection of different objects : You can perform one FFC per condition of Gain/setting of the Camera (4 Max) and recall one of the four global settings (Camera Configuration + FFC + Line Balance) when required.

FFC Adjust : A good usage.

When there are several Cameras to set up in a system on a single line, the most difficult is to have a uniform lightning whole along the line.
If each Camera performs its own Flat field correction, relative to the max of each pixel line, the result will be a succession of Camera lines at different levels.
=> The FFC Adjust function allows to set the same target value for all the Cameras in the system and then to get a perfect uniform line whole along the system with a precision of 1 LSB to the Target.

The reasonable value for the User Target is not more than around 20% of the max value of the line.

FFC User Bank Usage



At the power up :
- Last User Bank used is loaded in RAM

Reset a User bank :
- Reset the RAM (FPN/PRNU individually)
- Save in the bank to reset

6.3.13 LUTControl

The User can define or upload a LUT in the Camera that can be used at the end of the processing.
The LUT is defined as a correspondence between each of the 4096 gray levels (in 12 bits) with another outputted value. For example, a “negative” or “reverse” LUT is the following equivalence :

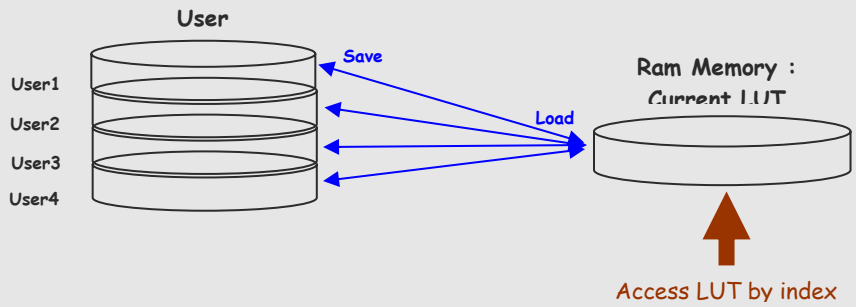
Real value	Output value
0	4095
1	4094
2	4093

Then the size of each value is 12bits but the exchanges with the Application/PC are done on 16 bits :
For 4096 gray levels (from 0 to 4095) the total file size for a LUT is 8Ko.

If the LUT is enabled, The Contrast Expansion (both Digital Gain & Offset) will be automatically disabled..

Name	Interface	Access	Visibility	Description
LUTEnable	IBoolean	R/W	E	Activates the current LUT.
LUTValueAll	IRegister	R/W	G	Accesses all the current LUT coefficients in a single access without using individual LUTIndex.
LUTValueSize	IInteger	R	G	Indicates the size (in Bytes) of LUT coefficient
LUTIndex	IInteger	R/W	G	Control the index (offset) of the coefficient to access in the current LUT
LUTValue	IInteger	R/W	G	Returns or set the Value at entry LUTIndex of the current LUT.
LUTSetSelector User1 User2 User3 User4	IEnumeration	R/W	G	Selects the LUT memory to save/load .
LUTSetSave	ICommand	R/W	G	Save the current LUT
LUTSetLoad	ICommand	R/W	G	Load the LUT in the memory defined by LUTSelector in the current LUT.
CurrentLUTSet	IInteger	R	G	Indicates the last LUT memory has been Saved/loaded and is active

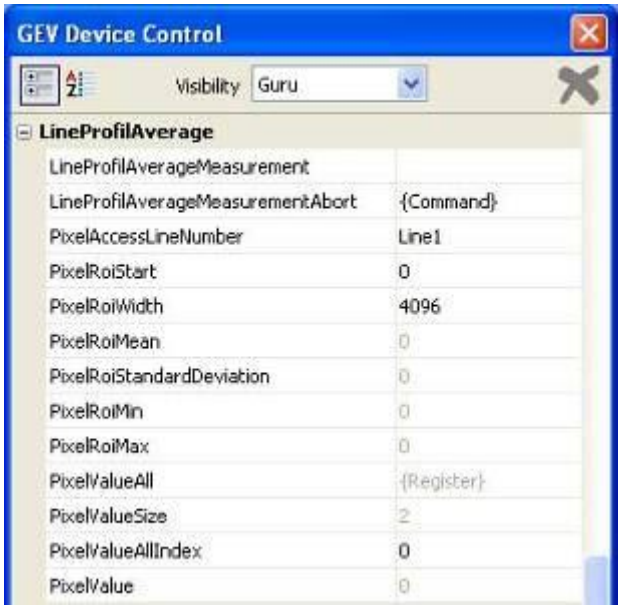
LUT User Bank Usage



At the power up :
- Last User Bank used (CurrentLUTSet) is loaded in RAM
reset

6.3.14 Statistics and Line Profile

This function allows the User to get some statistics on a pre-defined ROI. On request, the Camera acquires and then calculates some key values as the min, the max, the average or the standard deviation in this Region of Interest.



The grab and calculation command and also the collection of the results is not performed in real time as it is done through the register access.

The Calculated values are detailed as following :

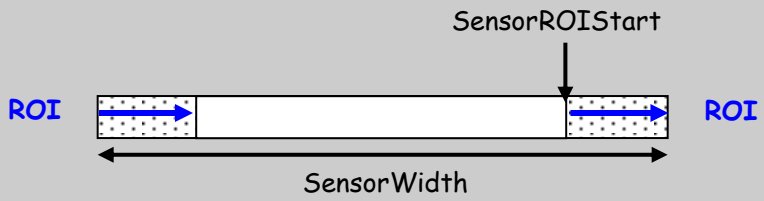
- **Pixel average Value** (*PixelROIMean*) : Average gray level value calculated on whole Region of interest : Unsigned format value : U12.4
- **Pixel Standard deviation** (*PixelROIStandardDeviation*) : standard deviation of all the pixel gray level values of Region of interest : Unsigned format value : U12.4
- **Pixel Min value** (*PixelROIMin*) : Minimum gray level pixel value on the whole region of interest.: Unsigned format value : U12.4
- **Pixel Max Value** (*PixelROIMax*) : Maximum gray level pixel value on the whole region of interest: Unsigned format value : U12.4

Name	Interface	Access	Visibility	Description
LineAverageProfileMeasurement	ICommand	R/W	E	Activates the current LUT.
LineAverageProfileMeasurementAbort	ICommand	R/W	G	Accesses all the current LUT coefficients in a single access without using individual LUTIndex.
PixelAccessLineNumber Line1 Line256 Line512 Line1024	IEnumeration	R/W	G	Select the number of lines to accumulate for the Line Profile processing : 1, 256, 512 or 1024 lines.
PixelROIStart	IInteger	R	G	Define the start of the ROI for the line processing.
PixelROIWidth	IInteger	R	G	Define the size of the ROI.
PixelROIMean	IFloat	R	G	Indicates the Average value on the ROI in LSB 12bits
PixelROIStandardDeviation	IFloat	R	G	Indicates the Standard deviation on the ROI in LSB 12bits
PixelROIMin	IInteger	R	G	Indicates the Minimum Value on the ROI in LSB 12bits
PixelROIMax	IInteger	R	G	Indicates the Maximum Value on the ROI in LSB 12bits
Name	**Interface**	**Access**	**Visibility**	**Description**

PixelValueAll	IRegister	R	G	Accesses all the current Pixel values in a single access without using individual PixelValueAllIndex.
PixelValueSize	IInteger	R	G	Indicated the size (in Bytes) of Pixel values (2 bytes)
PixelValueAllIndex	IInteger	R	G	Control the index (offset) of the Pixel to access in the ROI
PixelValue	IInteger	R	G	Returns the Value of the Pixel in the ROI pointed by PixelAllValueIndex

If PixelROIStart + PixelROIWidth > SensorWidth, then end of the ROI is set at :
PixelROIStart + PixelROIWidth - SensorWidth

It's the way to define a ROI composed of 2 x strips at the two sides of the sensor line :



6.3.15 SaveRestoreSettings

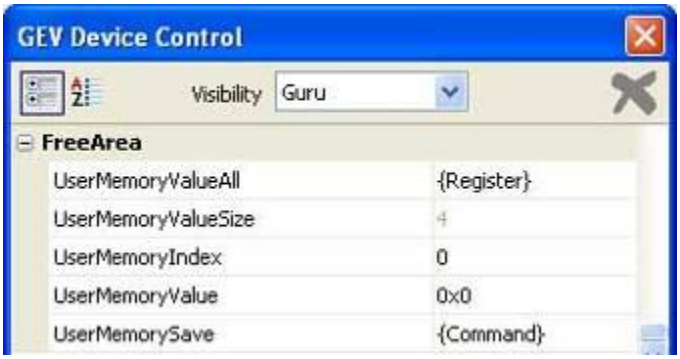
The settings (or Main configuration) of the Camera can be saved in 4 different User banks and one Integrator bank. This setting includes also the FFC and LUT enable parameters

Name	Interface	Access	Visibility	Description
UserSetSelector User1 User2 User3 User4 Integrator	IEnumeration	R/W	B	Selects the feature User Set to load or save.
UserSetSave	ICommand	(R)/W	B	Save the User Set specified by UserSetSelector to the non-volatile memory of the device.
UserSetLoad	ICommand	(R)/W	B	Loads the User Set specified by UserSetSelector to the device and makes it active.
CurrentUserSet	IInteger	R	B	Indicated the last User Set memory Saved/loaded

The integrator bank (5) can be written only if the Camera is set in integrator mode (Privilege level = 1). This integrator bank can be used as a « Factory default » by a system integrator.

6.3.16 FreeArea

In the memory of the camera there is a free area where the user can read and write his own values. This memory size is **1kByte** and allows the customer to save, for example, configuration of his system.
Feature **UserMemoryValueAll** is only available with the SDK and gives directly all memory values. It is possible to acces (R/W) with interactive tool if each block or 4 Bytes (32bits) written in this memory area with **UserMemoryIndex** and **UserMemoryValue** and save modifications with **UserMemorySave**.



Name	Interface	Access	Visibility	Description
UserMemoryValueAll	IRegister	R	G	Accesses all the Data in a single access without using individual UserMemoryAllIndex.
UserMemoryValueSize	IInteger	R	G	Indicated the size of the Data pointed by UserMemoryAllValueIndex (4 bytes)
UserMemoryAllIndex	IInteger	R	G	Control the index of each value to access in The User Memory area
UserMemoryValue	IInteger	R	G	Returns the data of the User Memory area pointed by UserMemoryAllValueIndex
UserMemorySave	ICommand	R	G	Save the User Memory in EEPROM

Packet_Resend mechanism

The AVIIVA EM1 camera embeds a dedicated memory to store the data frames in order to be able to resend packets when requested by the host driver.
If the host driver detects that one or multiple packets are missing then resend request commands are sent to the camera. This feature can be enabled or disabled depending on the GEV driver used. But this feature is always enabled in the AVIIVA EM1 camera.
In the AVIIVA EM1 camera the sensor stream has a higher priority than the packet_resend channel. This means that when the line frequency increases the time available for packet resend decreases. The AVIIVA EM1 camera has a 512Mbit memory let say 8192 packets of 8192 bytes.
If the host driver requests a single packet it sends a request command with the block_ID and the packet_ID. If it requests multiple following packets it sends a request command with the block_ID, the packet_ID of the first missing packet and the packet_ID of the last missing packet. The camera resend the packets provided there are still in its memory. If not the camera answers the requests with an extended status code (if enabled) indicating why the packets can't be resend.

7 APPENDIX A : Test Patterns

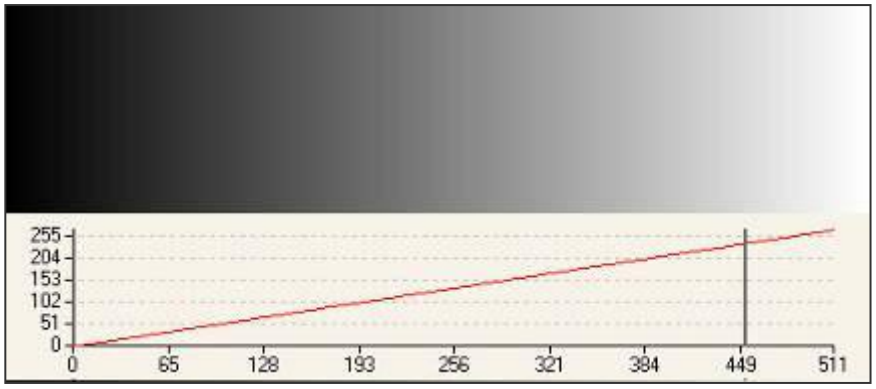
7.1 Test Pattern 1 : Vertical wave

The Test pattern 1 is a vertical moving wave : each new line will increment of 1 gray level in regards with the previous one.

- In 12 bits the level reaches 4095 before switching down to 0
- In 8 bits the level reaches 255 before switching down to 0

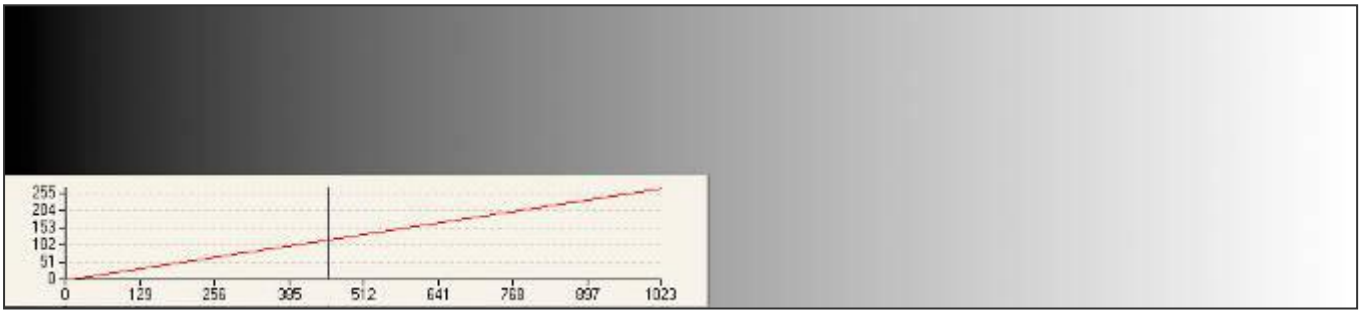
7.2 Test Pattern 2 : In 8 bits format

7.2.1 512 Pixels



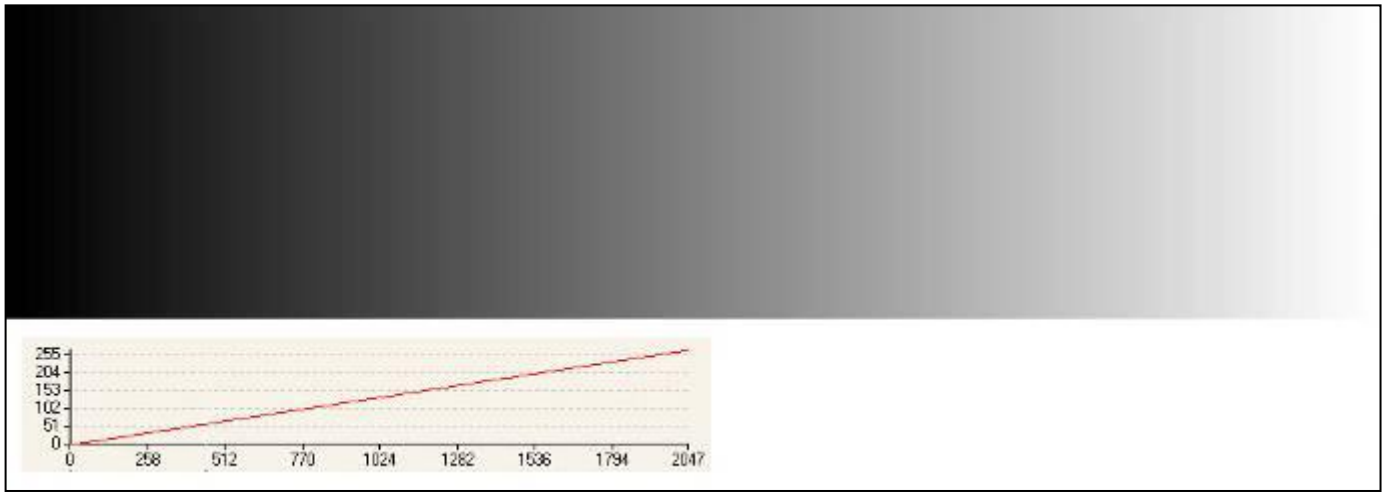
Pixel :	**1**	**2**	**3**	**4**	**5**	**…**	**509**	**510**	**511**	**512**
Value :	**0**	**0**	**1**	**1**	**2**	**…**	**254**	**254**	**255**	**255**

7.2.2 1024 Pixels



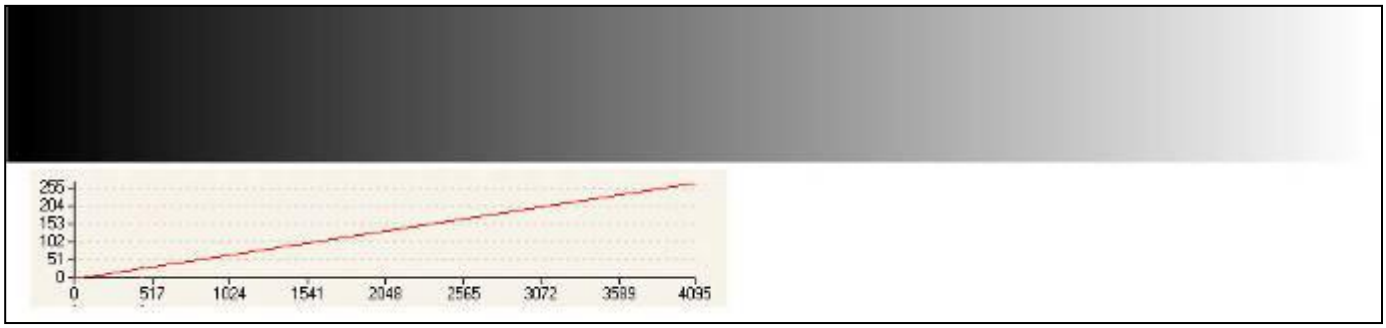
Pixel :	**1**	**2**	**3**	**4**	**5**	**…**	**1020**	**1021**	**1022**	**1023**	**1024**
Value :	**0**	**0**	**0**	**0**	**1**	**…**	**254**	**255**	**255**	**255**	**255**

7.2.3 2048 Pixels



Pixel :	1	2	3	…	8	9	…	2040	2041	…	2047	2048
Value :	0	0	0	…	0	1	…	254	255	…	255	255

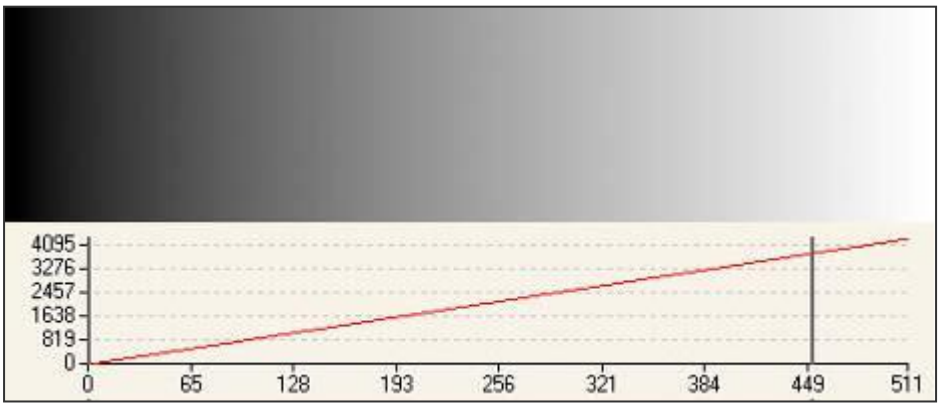
7.2.4 4096 Pixels



Pixel :	1	2	3	…	16	17	…	4080	4081	…	4095	4096
Value :	0	0	0	…	0	1	…	254	255	…	255	255

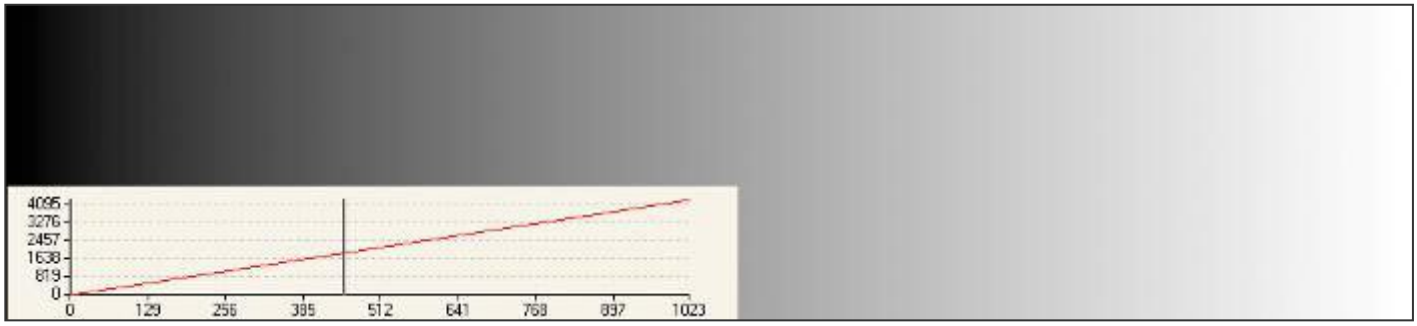
7.3 Test Pattern 2 : In 12 bits format

7.3.1 512 Pixels

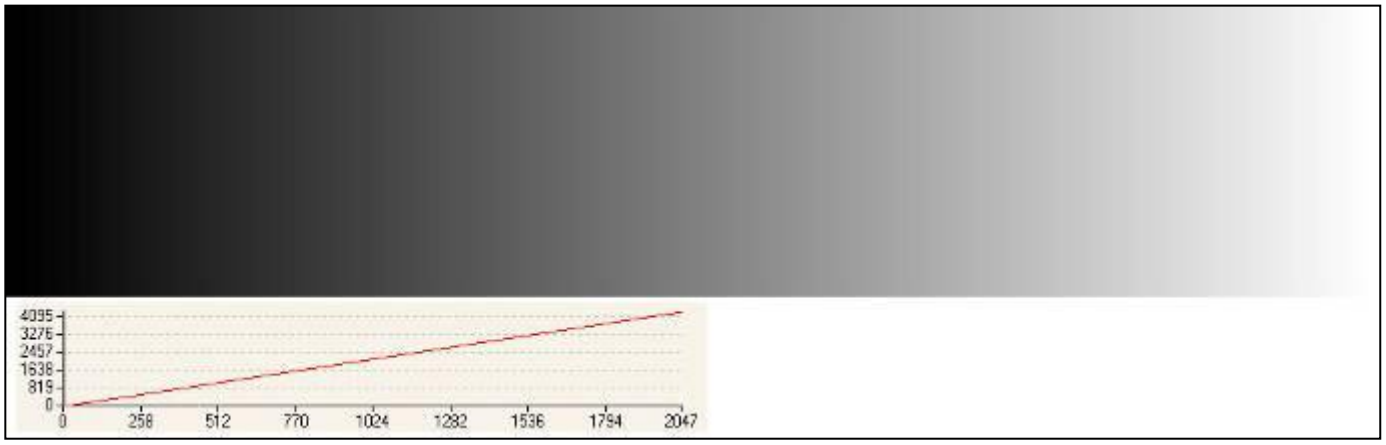


Pixel :	1	2	3	…	255	256	257	…	510	511	512
Value :	0	8	16	…	2040	2055	2063	…	4079	4087	4095

7.3.2 1024 Pixels

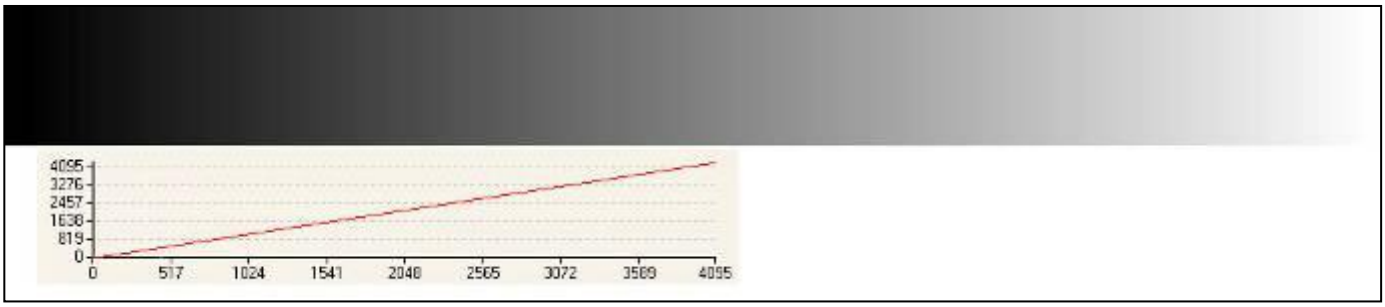


7.3.3 2048 Pixels



Pixel :	1	2	3	...	1024	1025	1026	...	2045	2046	2047	2048
Value :	0	2	4	...	2046	2049	2051	...	4089	4091	4093	4095

7.3.4 4096 Pixels



Pixel :	1	2	3	4	5	6	...	4092	4093	4094	4095	4096
Value :	0	1	2	3	4	5	...	4091	4092	4093	4094	4095

8 APPENDIX B : Thermal Management

8.1 Heat Sinks

The most important source of heat in the camera is around the sensor.
The EM1 Camera dissipates around 11W max with 4 taps at 31.25MHz (4K pixels version)
The Camera has been designed to dissipates the maximum of the internal heat through its front face : The packaging of the sensor is larger to increase the surface in contact with the front face and then improves the dissipation.
In the system, the camera has to be fixed by its front face with the largest contact possible with a metallic part.
Without any specific cooling system, a simple air flow around the camera will improve roughly the dissipation.

The EMx Camera series are already delivered with 2 Heat Sinks, but if necessary, additional heat sinks are available (set of 2) and they can be fixed on any side of the front face :

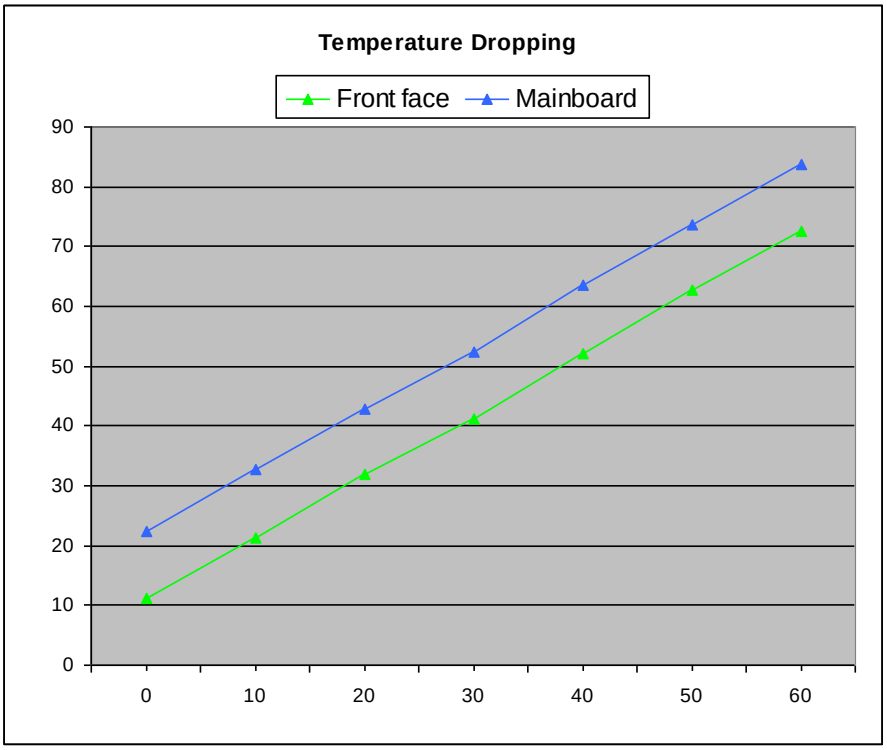
Set of 2 x Heat Sinks : Part number AT71KFPAVIVA-CAA

One heat sink can decrease the temperature of the front face of about 5°C down.

8.2 *Temperature dropping*

Some measurements have been done to establish the dropping temperature steps between different control points :

- Ambient room temperature (burning room with controlled pulsed air)
- Front Face of the Camera
- Internal Temperature sensor (measure available with DemoGev).



It has been established that the steps are the following (after a certain time) :

- Ambient room to Front Face about : **+ 10°C**
- Front Face to internal sensor about : **+ 15°C**

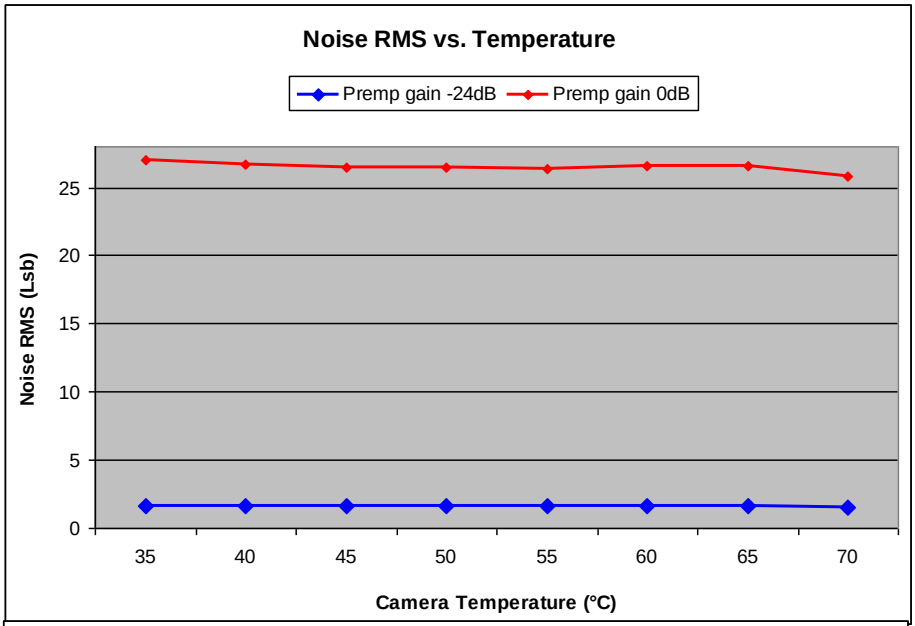
Then an average of **+ 25°C** between the room ambient temperature and the internal sensor.
The specification limits have been fixed at :

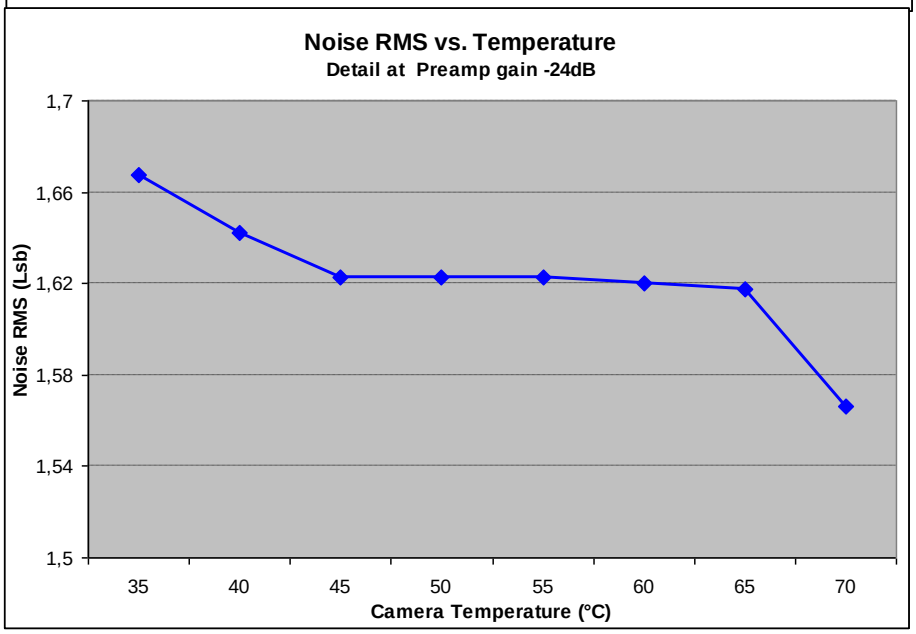
- **45°C for the ambient temperature**
- **55°C for the Front Face**
- **70°C internal Sensor.**

The ambient temperature is necessary defined here as a pulsed air or with an air flow around the camera otherwise the temperature around the Camera is not homogeneous and can be much more important than the one measured in the room.

8.3 *Performance curves versus Temperature*

- These curves have been established with a 4k Pixel Camera (worst case).
- The "Camera Temperature" is given by the internal Sensor of the Camera.
- All the values in LSB are in 12 bits

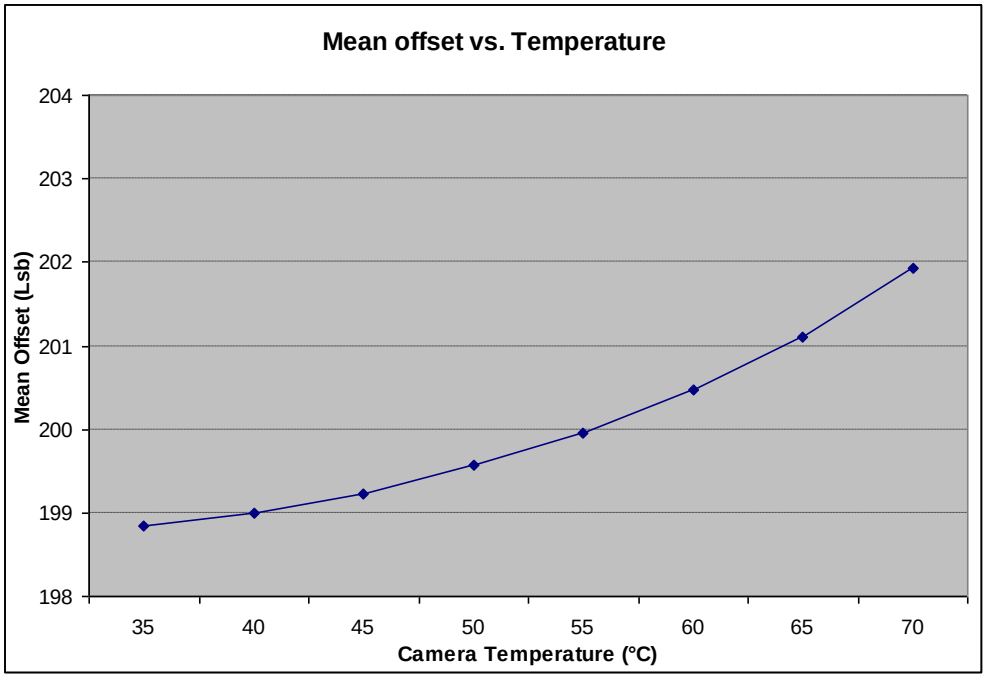


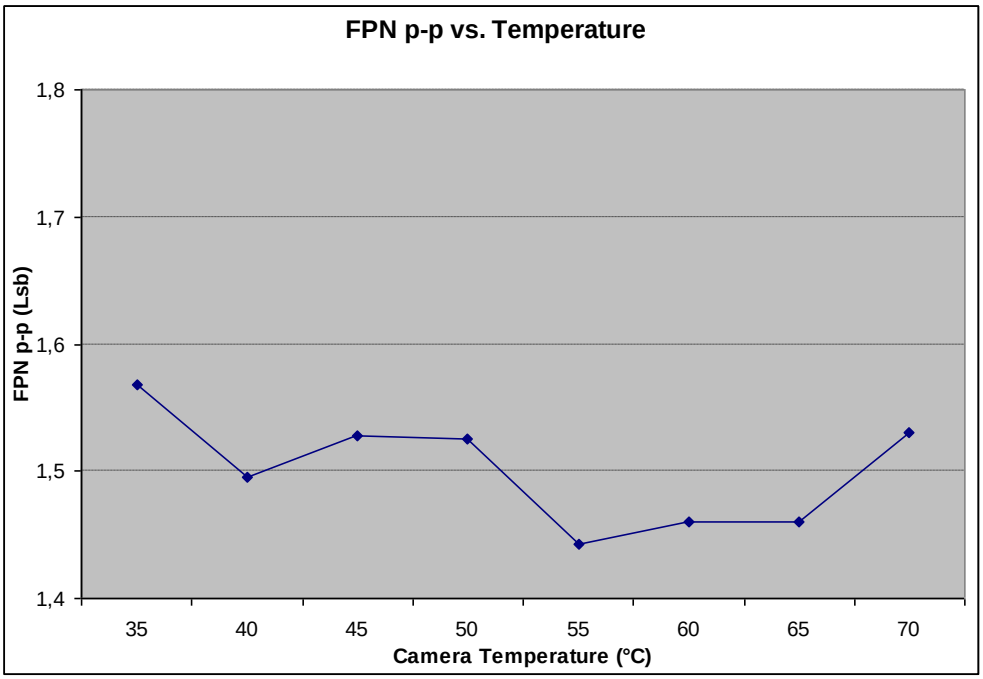


Darkness Noise vs Temperature : Detailed curve for the Min preamp Gain value

The Cameras tuning is done in factory after a certain time of warm up (close to a "normal condition of use) in order to ensure that the Camera will give its best while runing 24h a day. This explains a slight decreasing of the noise when the temperature rises up.

- The mean offset is the average value of the whole line of the sensor.
- The FPN peak to peak is the worst value for the whole line of the sensor.
- All the LSB values are in 12 bits

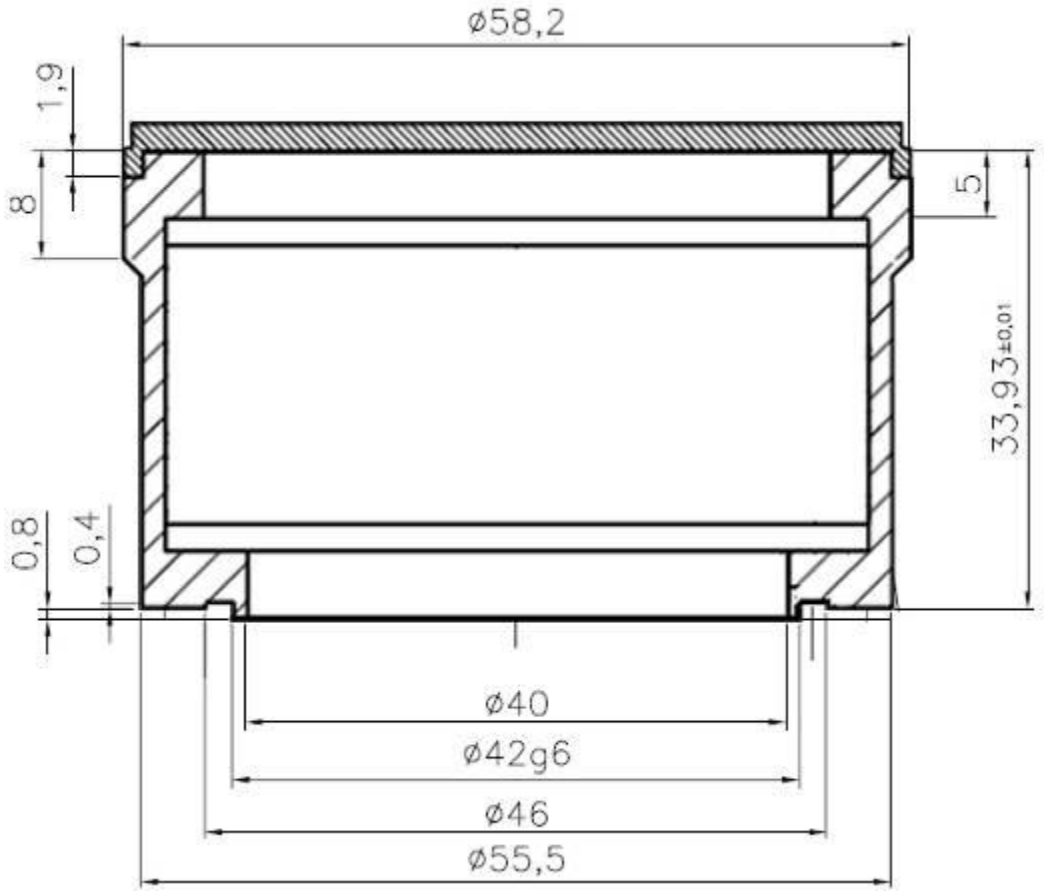

Mean offset vs. Temperature
Mean Offset (Lsb)
204
203
202
201
200
199
198
35
40
45
50
55
60
65
70
Camera Temperature (°C)


FPN p-p vs. Temperature
FPN p-p (Lsb)
1,8
1,7
1,6
1,5
1,4
35
40
45
50
55
60
65
70
Camera Temperature (°C)

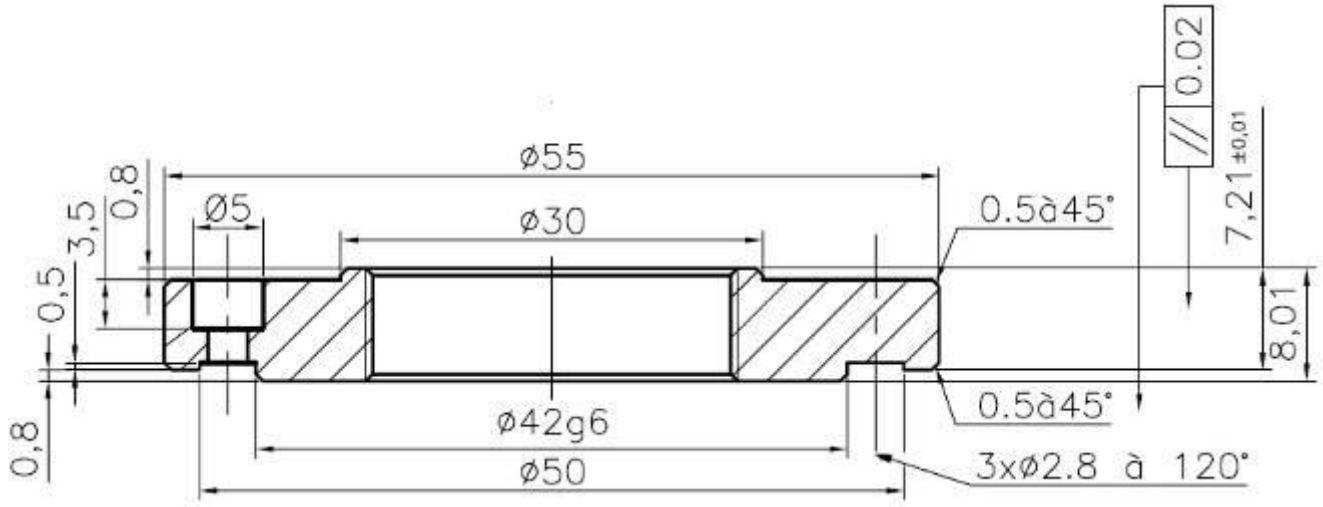
9 APPENDIX C : Optical Mounts available

9.1 F-Mount

F Mount : Kit10 (Part number AT71KFPAVIVA-ABA)

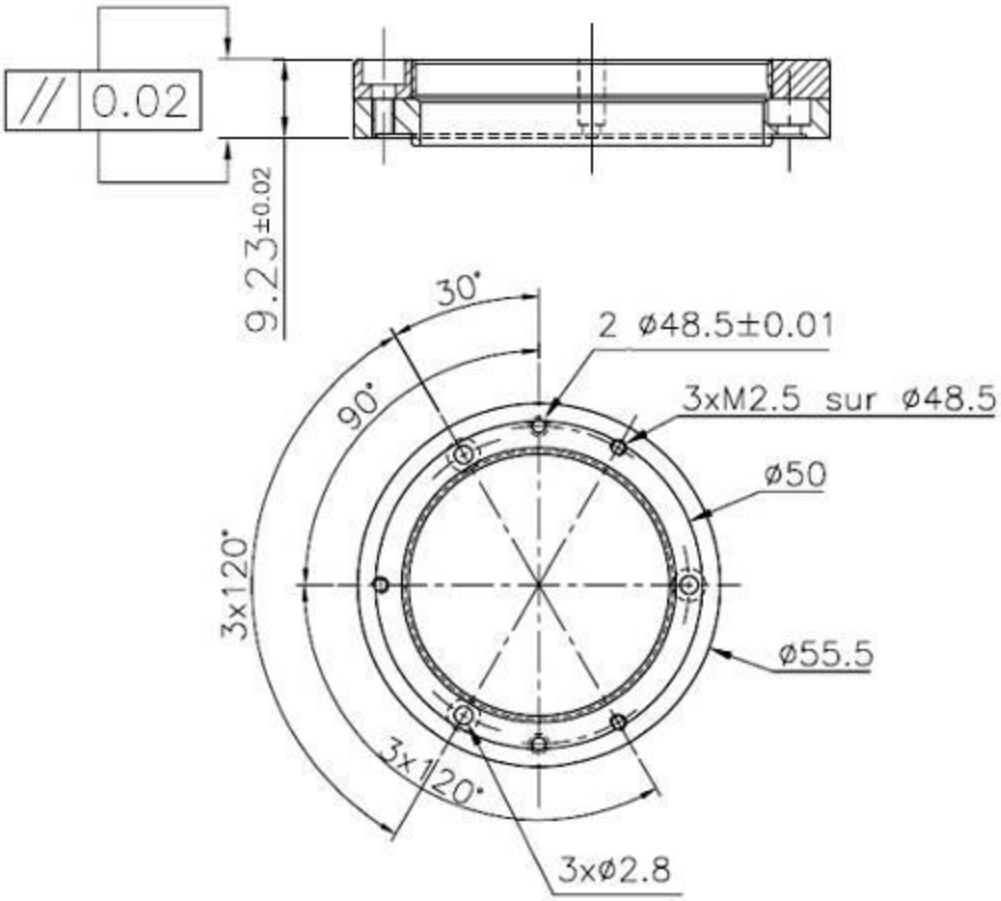


9.2 C-Mount


ø55
ø30
Ø5
0,8
3,5
0,5
0,8
0.5à45°
0.5à45°
0.02
7,21 ±0,01
8,01
ø42g6
ø50
3xø2.8 à 120°

9.3 T2 & M42x1 Mounts

M42x0,75 (T2 Mount) : Kit30 (Part number AT71KFPAVIVA-AKA)
M42x1 Mount : Kit40 (Part number AT71KFPAVIVA-ADA)



10 APPENDIX E : Index

11 APPENDIX E : Revision History

Manual Revision	Comments / Details	Firmware version	
1043A	First release of this manual	EM1 4010 BA0	1.6.4
		EM1 2014 BA0	1.9.4
		EM1 2014 BA9	1.3.4
		EM1 2010 BA9	1.3.4
1043B	EM2/EM4 new sensor : 1k 14µm	EM1 4010 BA0	1.6.9
		EM1 2014 BA0	1.9.9
		EM1 2014 BA9	1.3.9
		EM1 2010 BA9	1.3.9
		EM1 1014 BA0	1.0.0
		EM1 1014 BA9	1.0.0
		EM1 0514 BA0	-
1043C	EM2/EM4 new sensors : 1k 14µm and 512 14µm Packet Resend Technology with Pleora 2.x Package Camera Photos update “How to read Parameter Tables ?” Insert. Pattern Tests C-Mount	EM1 4010 BA0	1.6.9
		EM1 2014 BA0	1.9.9
		EM1 2014 BA9	1.3.9
		EM1 2010 BA9	1.3.9
		EM1 1014 BA0	1.1.1
		EM1 1014 BA9	1.0.1
		EM1 0514 BA0	1.0.1
1043D	New Documentation Template	EM1 4010 BA0	1.6.16
		EM1 2014 BA0	1.9.17
		EM1 2014 BA9	1.3.16
		EM1 2010 BA9	1.3.16
		EM1 1014 BA0	1.1.7
		EM1 1014 BA9	1.0.7
		EM1 0514 BA0	1.0.7

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